

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE		PAGE OF PAGES	
2. AMENDMENT/MODIFICATION NO.		3. EFFECTIVE DATE		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO. <i>(If applicable)</i>	
6. ISSUED BY		CODE		7. ADMINISTERED BY <i>(If other than Item 6)</i>		CODE	
8. NAME AND ADDRESS OF CONTRACTOR <i>(No., street, county, State and ZIP Code)</i>				(X)		9A. AMENDMENT OF SOLICIATION NO.	
						9B. DATED <i>(SEE ITEM 11)</i>	
						10A. MODIFICATION OF CONTRACT/ORDER NO.	
						10B. DATED <i>(SEE ITEM 11)</i>	
CODE		FACILITY CODE					

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers
☐ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. **FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER.** If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

**13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: <i>(Specify authority)</i> THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES <i>(such as changes in paying office, appropriation date, etc.)</i> SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER <i>(Specify type of modification and authority)</i>

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copy to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER <i>(Type or print)</i>		16A. NAME AND TITLE OF CONTRACTING OFFICER <i>(Type or print)</i>	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
<i>(Signature of person authorized to sign)</i>		<i>(Signature of Contracting Officer)</i>	

Item 14. Continued.

CHANGES TO BIDDING SCHEDULE

1. Replace the Bidding Schedule, pages 00010-3 thru 00010-6, with the accompanying new Bidding Schedule, bearing the notation "ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-03-B-0002."

CHANGES TO THE SPECIFICATIONS

2. New Sections - Add the following accompanying new sections, each bearing the notation "AMENDMENT NO. 0002" and add to the Table of Contents:

SECTION 01421R SWPPP INSPECTION AND MAINTENANCE REPORT
SECTION 01450 CHEMICAL DATA QUALITY CONTROL
SECTION 02111 EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL
SECTION 02120A TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS
SECTION 02919 TOPSOILING
SECTION 02964A COLD MILLING OF BITUMINOUS PAVEMENTS
SECTION 03004 MICRO-SURFACING (POLYMER MODIFIED)
SECTION 08520N ALUMINUM WINDOWS
SECTION 10450 WAIST-HIGH OPTICAL TURNSTILES
SECTION 16710A PREMISES DISTRIBUTION SYSTEM

3. Replacement Sections - Replace the following sections with the accompanying new sections of the same number and title, bearing the notation "AMENDMENT NO. 0002:"

SECTION 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE
SECTION 01421 OUTLINE OF A BASIC STORM WATER POLLUTION PREVENTION PLAN
SECTION 02090 LEAD-BASED PAINT (LBP) ABATEMENT AND DISPOSAL
SECTION 02220 DEMOLITION
SECTION 02300A EARTHWORK
SECTION 02315a EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS
SECTION 02316a EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS
SECTION 02466 DRILLED FOUNDATION CAISSONS (PIERS)
SECTION 02620A SUBDRAINAGE SYSTEM
SECTION 02630A STORM-DRAINAGE SYSTEM
SECTION 02714A DRAINAGE LAYER
SECTION 02721A SUBBASE COURSES
SECTION 02749 HOT-MIX ASPHALT (HMA) FOR AIRFIELDS
SECTION 02753A CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY-DUTY PAVEMENTS
SECTION 02821A FENCING
SECTION 07416a STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
SECTION 07430 COMPOSITE, FOAM-INSULATED, METAL WALL PANELS
SECTION 08120 ALUMINUM DOORS AND FRAMES
SECTION 08900 GLAZED CURTAIN WALL
SECTION 09000 BUILDING COLOR AND FINISH SCHEDULE
SECTION 10153 TOILET PARTITIONS
SECTION 13280A ASBESTOS ABATEMENT
SECTION 13920A FIRE PUMPS
SECTION 13930A WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
SECTION 15055 MECHANICAL EQUIPMENT, FUELING
SECTION 15190A GAS PIPING SYSTEMS
SECTION 15620A LIQUID CHILLERS
SECTION 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
SECTION 16526A AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS
SECTION 16527 AIRFIELD LIGHTING CONTROL AND MONITORING SYSTEM
SECTION 16711A TELEPHONE SYSTEM, OUTSIDE PLANT

4. Deleted Sections – Delete the following sections:

SECTION 02712A LIME-STABILIZED BASE COURSE, SUBBASE, OR SUBGRADE
SECTION 11145A AVIATION FUELING SYSTEMS

CHANGES TO THE DRAWINGS

5. Replacement Drawings.- Replace the drawings listed below with the attached new drawings of the same number, bearing the notation "AM #0002":

G-003FHD.cal 3 of 8	G-003 INDEX
G-007FHD.cal 7 of 8	G-007 REGULATED MATERIAL SURVEY LOCATIONS AND QUANTITIES. -
BLDG. NO 90050	
G-009FHD.cal 9 of 9	G-009 "REGULATED MATERIAL SURVEY LOCATIONS AND QUANTITIES. -
BLDG. NO. 90049, CONTROL TOWER	AND OPS. BUILDING"
c101.cal 1 of 124	C-101 PROJECT LOCATION MAP AND GENERAL NOTES
c102.cal 2 of 124	C-102 HAUL ROUTE
c504.cal 4 of 124	C-504 PAVEMENT DETAILS
c505.cal 5 of 124	C-505 PAVEMENT DETAILS
c506.cal 6 of 124	C-506 PAVEMENT DETAILS
c510.cal 10 of 124	C-510 SECURITY GATE DETAILS
c517.cal 17 of 124	C-517 MISCELLANEOUS DETAILS
c518.cal 18 of 124	C-518 MISCELLANEOUS DETAILS
ca101dem.cal 30 of 124	CA101 "DEMOLITION PLAN, DEPLOYMENT CENTER"
ca106jnt.cal 35 of 124	CA106 "JOINT LAYOUT PLAN, DEMOLITION CENTER"
cc107swp.cal 45 of 124	CC107 "SWPPP, BASE OPERATIONS BUILDING"
ch101dem.cal 105 of 124	CH101 "DEMOLITION PLAN, AIRCRAFT PARKING APRON"
ch102dem.cal 106 of 124	CH102 "DEMOLITION PLAN, AIRCRAFT PARKING APRON"
ch109jnt.cal 113 of 124	CH109 "JOINT LAYOUT PLAN, AIRCRAFT PARKING APRON"
ch110jnt.cal 114 of 124	CH110 "JOINT LAYOUT PLAN, AIRCRAFT PARKING APRON"
ch114str.cal 118 of 124	CH114 "STRIPING PLAN, AIRCRAFT PARKING APRON"
AA106dpl.cal 6 of 120	AA106 DEPLOYMENT FACILITY FLOOR PLAN - MANIFEST AREA
AA303dpl.cal 29 of 120	AA303 DEPLOYMENT FACILITY WALL SECTIONS
AA306dpl.cal 32 of 120	AA306 DEPLOYMENT FACILITY WALL SECTIONS
AA502dpl.cal 42 of 120	AA502 DEPLOYMENT FACILITY PLAN DETAILS
AA510dpl.cal 49 of 120	AA510 DEPLOYMENT FACILITY SECTION DETAILS
AA520dpl.cal 50 of 120	AA520 DEPLOYMENT FACILITY ROOF DETAILS
AA530dpl.cal 53 of 120	AA530 DEPLOYMENT FACILITY DOOR AND WINDOW DETAILS
AA610dpl.cal 64 of 120	AA610 DEPLOYMENT FACILITY PARTITION TYPES
AB301whs.cal 78 of 120	AB301 PALLET WAREHOUSE WALL SECTIONS
AB510whs.cal 81 of 120	AB510 PALLET WAREHOUSE PLAN AND SECTION DETAILS
AB531whs.cal 86 of 120	AB531 PALLET WAREHOUSE WINDOW DETAILS
AC610bop.cal 115 of 120	AC610 BASE OPERATIONS FACILITY PARTITION TYPES
AC611bop.cal 116 of 120	AC611 BASE OPERATIONS FACILITY PARTITION TYPES
S-001gen.cal 1 of 20	S-001 GENERAL NOTES
S-002gen.cal 2 of 20	S-002 STANDARD DETAILS
SA101dpl.cal 4 of 20	SA101 DEPLOYMENT FACILITY FOUNDATION PLAN
SA102dpl.cal 5 of 20	SA102 DEPLOYMENT FACILITY SECOND FLOOR FRAMING PLAN
SA103dp2.cal 6 of 20	SA103 DEPLOYMENT FACILITY ROOF FRAMING PLAN
SA104dpl.cal 7 of 20	SA104 DEPLOYMENT FACILITY CANOPY FOUNDATION AND FRAMING PLAN
SA501dpl.cal 8 of 20	SA501 DEPLOYMENT FACILITY SECTIONS
SA502dpl.cal 9 of 20	SA502 DEPLOYMENT FACILITY SECTIONS
SA505dpl.cal 12 of 20	SA505 DEPLOYMENT FACILITY SECTIONS
SB101whs.cal 13 of 20	SB101 PALLET WAREHOUSE FOUNDATION PLAN
SB502whs.cal 15 of 20	SB502 PALLET WAREHOUSE SECTIONS
SC101bop.cal 16 of 20	SC101 BASE OPERATIONS BUILDING FOUNDATION PLAN
SC102bop.cal 17 of 20	SC102 BASE OPERATIONS BUILDING ROOF FRAMING PLAN
SC501bop.cal 18 of 20	SC501 BASE OPERATIONS BUILDING SECTIONS
SC502bop.cal 19 of 20	SC502 BASE OPERATIONS BUILDING SECTIONS
pc201bop.cal 17 of 23	PC201 BASE OPERATIONS BUILDING PLUMBING RISER
MA503dpl.cal 19 of 46	MA503 DEPLOYMENT FACILITY MECHANICAL DETAILS

MA504dp1.cal	20 of 46	MA504	DEPLOYMENT FACILITY MECHANICAL DETAILS
MA602dp1.cal	22 of 46	MA602	DEPLOYMENT FACILITY MECHANICAL SCHEDULES
MB101whs.cal	23 of 46	MB101	PALLET WAREHOUSE HVAC PLAN
MB501whs.cal	27 of 46	MB501	PALLET WAREHOUSE MECHANICAL DETAILS
MC203bop.cal	33 of 46	MC203	BASE OPERATIONS BUILDING MECHANICAL CONTROLS
MC501bop.cal	41 of 46	MC501	BASE OPERATIONS BUILDING MECHANICAL DETAILS
MC502bop.cal	42 of 46	MC502	BASE OPERATIONS BUILDING MECHANICAL DETAILS
MC504bop.cal	46 of 46	MC504	BASE OPERATIONS BUILDING MECHANICAL DETAILS
e006.cal	6 OF 69	E-006	ELECTRICAL DETAILS
eg101spl.cal	9 OF 69	E-101	PARTIAL ELECTRICAL SITE PLAN
eg102spl.cal	10 OF 69	E-102	PARTIAL ELECTRICAL SITE PLAN
eg103spl.cal	11 OF 69	E-103	PARTIAL ELECTRICAL SITE PLAN
eg104spl.cal	12 OF 69	E-104	PARTIAL ELECTRICAL SITE PLAN
ea101dpx.cal	11 OF 69	EA101	DEPLOYMENT FACILITY ELECTRICAL SITE PLAN
ea109ds1.cal	19 OF 69	EA109	DEPLOYMENT FACILITY MANIFEST AREA SPECIAL SYSTEMS PLAN
ea110ds1.cal	20 OF 69	EA110	"DEPLOYMENT FACILITY TROOP AREA "B" SPECIAL SYSTEMS PLAN"
ea113ds2.cal	23 OF 69	EA113	DEPLOYMENT FACILITY SECOND FLOOR SPECIAL SYSTEMS PLAN
ec101bop.cal	36 OF 69	EC101	BASE OPERATIONS BUILDING ELECTRICAL SITE PLAN
eu101.cal	44 OF 69	EU101	ELECTRICAL SITE PLAN - AREA 1
eu102.cal	45 OF 69	EU102	ELECTRICAL SITE PLAN - AREA 2
eu104.cal	47 OF 69	EU104	ELECTRICAL SITE PLAN - AREA 4
eu106.cal	49 OF 69	EU106	ELECTRICAL SITE PLAN - AREA 6
eu107.cal	50 OF 69	EU107	ELECTRICAL SITE PLAN - AREA 7
eu112.cal	55 OF 69	EU112	ELECTRICAL SITE PLAN - AREA 12
eu113.cal	56 OF 69	EU113	ELECTRICAL SITE PLAN - AREA 13
eu114.cal	57 OF 69	EU114	APRON LIGHTING INTENSITY PLAN
eu501.cal	58 OF 69	EU501	EAST LIGHTING VAULT PLAN AND MANHOLE DETAILS
eu505.cal	62 OF 69	EU505	"PAVEMENT, DUCT DETAILS AND CONTROL DIAGRAM"
eu506.cal	63 OF 69	EU506	MISCELLANEOUS DETAILS
eu507.cal	64 OF 69	EU507	APRON LIGHTING CONTROL DIAGRAM
fa101dph.cal	2 of 8	FA101	DEPLOYMENT BUILDING 1st FLOOR FIRE PROTECTION
fa102dph.cal	3 of 8	FA102	DEPLOYMENT BUILDING 2nd FLOOR FIRE PROTECTION
fsb101w.cal	5 of 8	FB101	PALLET WAREHOUSE FIRE SPRINKLER PLAN
fsc101b.cal	7 of 8	FC101	BASE OPERATIONS BUILDING FIRE SPRINKLER PLAN
EX001.cal		EX001	APPROACH LIGHTING ELECTRICAL KEY PLAN
EX103.cal		EX103	ELECTRICAL DEMOLITION PLAN AREA 3
EX106.cal		EX106	ELECTRICAL SITE PLAN AREAS 1 & 1A
EX107.cal		EX107	ELECTRICAL SITE PLAN AREA 2
EX110.cal		EX110	ELECTRICAL SITE PLAN AREA 10
EX111.cal		EX111	ELECTRICAL SITE PLAN AREA 11
EX112.cal		EX112	ELECTRICAL SITE PLAN AREA 12
EX113.cal		EX113	ELECTRICAL SITE PLAN AREA 13
EX114.cal		EX114	ELECTRICAL SITE PLAN AREA 17
EX115.cal		EX115	ELECTRICAL SITE PLAN AREA 18
EX116.cal		EX116	ELECTRICAL SITE PLAN AREA 19
EX117.cal		EX117	ELECTRICAL SITE PLAN AREA 20
EX118.cal		EX118	BASE BID ELECTRICAL SITE PLAN AREA 21
EX119.cal		EX119	BASE BID ELECTRICAL SITE PLAN AREA 22
EX120.cal		EX120	ELECTRICAL SITE PLAN AREA 23
EX401.cal		EX401	LIGHTING VAULT EQUIPMENT PLAN
EX503.cal		EX503	PAVEMENT REPLACEMENT DETAILS FOR AIRFIELD LIGHTING
EX601.cal		EX601	RUNWAY & APPROACH LIGHTING WIRING DIAGRAM 1
EX603.cal		EX603	LIGHTING VAULT POWER RISER DIAGRAM

END OF AMENDMENT

ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-03-B-0002

Fixed Wing Aircraft Parking Apron, Phase II (Title)
Fort Hood, Texas (Location)

Sollicitation No.DACA63-03-B-0002

BIDDING SCHEDULE
 (To be attached to SF 1442)

BASE BID: All work required by the plans and specifications exclusive of work required by Option Bid Items.

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount	
0001	Deployment Facility; complete, including utilities to the 1524mm (5-ft) line, and exclusive of all other work listed separately.					
		Job	Sum	***	\$ _____	
0002	Pallet Warehouse complete, including utilities to the 1524mm (5-ft) line, and exclusive of all other work listed separately.					
		Job	Sum	***	\$ _____	
0003	Base Operations Building complete, including utilities to the 1524mm (5-ft) line, and exclusive of all other work listed separately.					
		Job	Sum	***	\$ _____	
0004	Drilled Piers					
0004AA	457mm (18-In) Drilled Piers	384 (Am#2)	M	\$ _____	\$ _____	
0004AB	457mm (18-In) Casings	38 (Am#2)	M	\$ _____	\$ _____	
0004AC	610mm (24-In) Drilled Piers	332 (Am#2)	M	\$ _____	\$ _____	
0004AD	610mm (24-In) Casings	33 (Am#2)	M	\$ _____	\$ _____	
0004AG	762mm (30-In) Drilled Piers	14 (Am#2)	M	\$ _____	\$ _____	
0004AH	762mm (30-In) Casings	2 (Am#2)	M	\$ _____	\$ _____	
(Am#1)	0004AJ	915mm (36-In) Drilled Piers	36 (Am#2)	M	\$ _____	\$ _____
(Am#1)	0004AK	915mm (36-In) Casings	4 (Am#2)	M	\$ _____	\$ _____
0005	Aircraft Parking Apron	Job	Sum	***	\$ _____	
0006	Ammo Upload Road	Job	Sum	***	\$ _____	
0007	Runway Approach Lighting	Job	Sum	***	\$ _____	
0008	Taxiway Rehabilitation	Job	Sum	***	\$ _____	

ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-03-B-0002

Fixed Wing Aircraft Parking Apron, Phase II (Title)
Fort Hood, Texas (Location)

Sollicitation No.DACA63-03-B-0002

BIDDING SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0009	Rotary Wing Helicopter Apron Job		Sum	***	\$ _____
0010	HTRW Abatement Job		Sum	***	\$ _____
0011	Airfield Signage & Lighting Job		Sum	***	\$ _____
(Am#2) 0012	150mm Reinforced Concrete				
	Pavement	209	M3	\$ _____	\$ _____
(Am#2) 0013	180mm Reinforced Concrete				
	Pavement	430	M3	\$ _____	\$ _____
(Am#2) 0014	230mm Non-reinforced Concrete				
	Pavement	1,323	M3	\$ _____	\$ _____
(Am#2) 0015	381mm Non-reinforced Concrete				
	Pavement	7,304	M3	\$ _____	\$ _____
(Am#2) 0016	381mm Reinforced Concrete				
	Pavement	199	M3	\$ _____	\$ _____
(Am#2) 0017	High Stability Hot Mix				
	Surface Course	1,020	MT	\$ _____	\$ _____
0018	Construct all Exterior (Including utilities, earthwork, paving, sidewalk, curb and gutter, screen walls, demolition and landscaping and all work listed separately)				
		Job	Sum	***	\$ _____
0019	Final As-Built Drawings	Job	Sum	***	\$ <u>100,000.00</u>
0020	Operation and Maintenance Manuals	Job	Sum	***	\$ <u>27,000.00</u>
0021	Mobilization and Demobilization	Job	Sum	***	\$ _____

ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-03-B-0002

Fixed Wing Aircraft Parking Apron, Phase II (Title)
Fort Hood, Texas (Location)

Sollicitation No.DACA63-03-B-0002

BIDDING SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0022	Warranty Work (All Contract Work)				
	The monetary value of this bid item shall equal at least 1 per cent of the total of all bid items preceding it. A value less than 1 per cent will result in a determination of non-responsive bid. See Contract Specification Section 01770F CONTRACT CLOSEOUT, paragraph "Contractor's Response to Construction Warranty Service Requirements."				

Job Sum *** \$ _____

TOTAL BASE BID \$ _____

OPTION NO. 1: Additional cost for all work required by the plans and Specifications for the Airfield Parking Apron M.O.G. 7

<u>(Am#2) 0023</u>	<u>381mm Non-reinforced Concrete</u>				
	<u>Pavement</u>	<u>4,900</u>	<u>M3</u>	<u>\$ _____</u>	<u>\$ _____</u>
<u>(Am#2) 0024</u>	<u>All other work not separately</u>				
	<u>listed</u>	<u>Job</u>	<u>Sum</u>	<u>***</u>	<u>\$ _____</u>

TOTAL OPTION NO. 1 \$ _____

TOTAL BASE BID PLUS OPTION No. 1 \$ _____

<u>Fixed Wing Aircraft Parking Apron, Phase II</u>	(Title)
<u>Fort Hood, Texas</u>	(Location)

Sollicitation No.DACA63-03-B-0002

BIDDING SCHEDULE

NOTES:

1. ARITHMETIC DISCREPANCIES (EFARS 14.407-2)

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by bidders:

- (1) Obviously misplaced decimal points will be corrected;
- (2) In case of discrepancy between unit price and extended price, the unit price will govern;
- (3) Apparent errors in extension of unit prices will be corrected; and
- (4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purpose of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

2. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the bid schedule.

3. Bidders must bid on all items.

4. Costs attributable to Division 01 - General Requirements are assumed to be prorated among bid items listed.

5. Responders are advised that this requirement may be delayed, cancelled or revised at any time during the solicitation, selection, evaluation, negotiation and/or final award process based on decisions related to DOD changes in force structure and disposition of the Armed Forces.

<u>Fixed Wing Aircraft Parking Apron, Phase II</u>	(Title)
<u>Fort Hood, Texas</u>	(Location)

Sollicitation No.DACA63-03-B-0002

BIDDING SCHEDULE

NOTES: (cont)

6. For the purpose of this solicitation, the word "item" shall be considered to mean "schedule" as used in Provision 52.214-0019, CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION, in Section 00100 INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS.

7. EXERCISE OF OPTIONS (SWDR 715-1-1 (16 January 1996))

The Government reserves the right to exercise the option(s) by written notice to the Contractor either singularly or in any combination for up to 90 calendar days after award of the Base Bid without an increase in the Offeror's Bid Price. Completion of added items shall continue at the same schedule as the Base Bid unless otherwise noted in Section 01000 CONSTRUCTION SCHEDULE, paragraph 1 entitled SCHEDULE.

8. ABBREVIATIONS

For the purpose of this solicitation, the units of measure are represented as follows:

- a. EA (each)
- b. GAL (gallons)
- c. CF (cubic feet)
- d. SF (square feet)
- e. LF (linear feet)
- f. LS (lump sum)
- g. MM (millimeters)
- h. LM (length in linear meters)

(Am#2) i. M3 (Cubic Meters)

(Am#2) j. MT (Metric Ton)

END OF BIDDING SCHEDULE

SECTION 01351

SAFETY, HEALTH, AND EMERGENCY RESPONSE
AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Threshold Limits	(1998) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices
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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z358.1	(1990) Emergency Eyewash and Shower Equipment
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AMERICAN PETROLEUM INSTITUTE (API)

API Publ 2219	(1986) Safe Operation of Vacuum Trucks in Petroleum Service
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API RP 1604	(1996) Closure Underground Petroleum Storage Tanks
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API Std 2015	(1994) Safe Entry and Cleaning of Petroleum Storage Tanks
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CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
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29 CFR 1910	Occupational Safety and Health Standards
-------------	------------------------------------------

29 CFR 1926	Safety and Health Regulations for Construction
-------------	------------------------------------------------

49 CFR 171	General Information, Regulations, and Definitions
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49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
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ENGINEERING MANUALS (EM)

EM 385-1-1	(1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual
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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 85-115

(1985) Occupational Safety and Health
Guidance Manual for Hazardous Waste Site
Activities

1.2 DESCRIPTION OF WORK

This section provides additional safety and health requirements for the accident prevention provisions of EM 385-1-1, which specifies a Site Safety and Health Plan (SSHP) that shall satisfy the requirements for submission and acceptance as required by EM 385-1-1. These requirements shall apply to work performed in both "contaminated" and "clean" areas.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Work Zones; FIO.

Drawings shall include initial work zone boundaries: Exclusion Zone (EZ), including restricted and regulated areas; Contamination Reduction Zone (CRZ); and Support Zone (SZ).

Decontamination Facilities; FIO.

Drawings shall show the layout of the personnel and equipment decontamination areas.

SD-09 Reports

Monitoring/Sampling Results; FIO.

SD-13 Certificates

Safety and Health for Hazardous Waste Sites; GA.

Certificates of training in accordance with 29 CFR 1910.120 from all workers involved in this project.

Personnel exposure monitoring/sampling results.

Site Control Log; FIO.

Record of each entry and exit into the site, as specified.

1.4 REGULATORY REQUIREMENTS

Work performed under this contract shall comply with EM 385-1-1, applicable Federal, state, and local safety and occupational health laws and regulations. This includes, but is not limited to, Occupational Safety and Health Administration (OSHA) standards, 29 CFR 1910, especially Section .120, "Hazardous Waste Site Operations and Emergency Response" and 29 CFR 1926, especially Section .65, "Hazardous Waste Site Operations and Emergency Response". Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria,

ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5 PRECONSTRUCTION SAFETY CONFERENCE

See below paragraph ACCEPTANCE OR MODIFICATIONS.

1.6 SAFETY AND HEALTH PROGRAM

OSHA Standards 29 CFR 1910, Section .120 (b) and 29 CFR 1926, Section .65 (b) require employers to develop and implement a written Safety and Health Program for employees involved in hazardous waste operations. The site-specific program requirements of the OSHA Standards shall be integrated into one site-specific document, the Site Safety and Health Plan (SSHP). The SSHP shall interface with the employer's overall Safety and Health Program. Any portions of the overall Safety and Health Program that are referenced in the SSHP shall be included as appendices to the SSHP.

1.7 SITE SAFETY AND HEALTH PLAN

1.7.1 Preparation and Implementation

A Site Safety and Health Plan (SSHP) shall be prepared covering onsite work to be performed by the Contractor and all subcontractors. The Safety and Health Manager shall be responsible for the development, implementation and oversight of the SSHP. The SSHP shall establish, in detail, the protocols necessary for the anticipation, recognition, evaluation, and control of hazards associated with each task performed. The SSHP shall address site-specific safety and health requirements and procedures based upon site-specific conditions. The level of detail provided in the SSHP shall be tailored to the type of work, complexity of operations to be performed, and hazards anticipated. Details about some activities may not be available when the initial SSHP is prepared and submitted. Therefore, the SSHP shall address, in as much detail as possible, anticipated tasks, their related hazards and anticipated control measures. Additional details shall be included in the activity hazard analyses as described in paragraph ACTIVITY HAZARD ANALYSES.

1.7.2 Acceptance and Modifications

Prior to submittal, the SSHP shall be signed and dated by the Safety and Health Manager and the Site Superintendent. The SSHP shall be submitted for review 21 working days prior to the Preconstruction Conference. Deficiencies in the SSHP will be discussed at the preconstruction safety conference, and the SSHP shall be revised to correct the deficiencies and resubmitted for acceptance. Onsite work shall not begin until the plan has been accepted. A copy of the written SSHP shall be maintained onsite. As work proceeds, the SSHP shall be adapted to new situations and new conditions. Changes and modifications to the accepted SSHP shall be made with the knowledge and concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Should any unforeseen hazard become evident during the performance of the work, the Site Safety and Health Officer (SSHO) shall bring such hazard to the attention of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, necessary action shall be taken to re-establish and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Disregard for the provisions of this specification or the accepted SSHP shall be cause for stopping of work until the matter has been rectified.

1.7.3 Availability

The SSHP shall be made available in accordance with 29 CFR 1910, Section .120 (b)(1)(v) and 29 CFR 1926, Section .65 (b)(1)(v).

1.7.4 Elements

Topics required by 29 CFR 1910, Section .120 (b)(4) 29 CFR 1926, Section .65 (b)(4) and the Accident Prevention Plan as described in Appendix A of EM 385-1-1 and those described in this section shall be addressed in the SSHP.

Where the use of a specific topic is not applicable to the project, the SSHP shall include a statement to justify its omission or reduced level of detail and establish that adequate consideration was given the topic.

1.8 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

1.8.1 Project/Site Conditions

The following information is a record of site contaminants and a description of the site. This information is provided to assist in preparing the SSHP.

1.8.1.1 Site Information

The hydrant fueling system (see Section 02115 - HYDRANT FUELING SYSTEM REMOVAL) addressed by this project have been confirmed as having contained JP-8 fuel.

1.8.1.2 List of Available Documents

Further information is available from Section 01450 - CHEMICAL DATA QUALITY CONTROL.

1.8.2 Plan Requirements

The SSHP shall include a site description and contamination characterization section that addresses the following elements:

a. Description of site location, topography, size and uses of the site.

b. A list of contaminants which may present occupational health and safety hazards. This list shall be created by evaluating the analytical results from sampling and testing in Section 01450 - CHEMICAL DATA QUALITY CONTROL. Chemical names, concentration ranges, media in which found, locations onsite, and estimated quantities/volumes to be impacted by site work shall be included if known. The contamination characterization shall be reviewed and revised if new chemicals are identified as work progresses.

1.8.3 Not Used

1.9 HAZARD/RISK ANALYSIS

The SSHP shall include a safety and health hazard/risk analysis for each site task and operation to be performed. The hazard/risk analysis shall provide information necessary for determining safety and health procedures, equipment, and training to protect onsite personnel, the environment (via storm runoff), and the public. Available site information shall be reviewed when preparing the "Hazard/Risk Analysis" section of the SSHP. The following elements, at a minimum, shall be addressed.

1.9.1 Site Tasks and Operations (Workplan)

The SSHP shall include a comprehensive section that addresses the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives. The Contractor shall develop a list of anticipated major site tasks and operations to be performed from description of work in Section 02115 - HYDRANT FUELING SYSTEM REMOVAL. This list of site tasks and operations shall be expanded and/or revised, after initial chemical analytical results are available or after site evaluation, as necessary.

1.9.2 Hazards

The following potential hazards and safety issues listed in paragraphs 1.18.6 through 1.18.20 may be encountered during site work. These are not complete lists; therefore, they shall be expanded and/or revised as necessary during preparation of the SSHP after site visit. The Contractor shall take into consideration of all potential hazards and safety issues of concern to develop the SSHP.

1.9.2.1 Safety Hazards

Potential safety hazards associated with excavation, trenching, backfilling, and stockpiling activities. The SSHP shall address exposure to safety hazards in accordance with EM 385-1-1

1.9.2.2 Chemical Hazards

Potential chemical hazards that may be encountered during site work are discussed in paragraph SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION.

The Hazard/Risk Analysis section of the SSHP shall describe the chemical, physical, and toxicological properties of contaminants, sources and pathways of employee exposures, anticipated onsite and offsite exposure level potentials, and regulatory (including Federal, state, and local) or recommended protective exposure standards. The SSHP shall also address employee exposure to hazardous substances brought onsite, and shall comply with the requirements of 29 CFR 1910, Section .1200 and 29 CFR 1926, Section .59, Hazard Communication.

1.9.2.3 Physical Hazards

Potential physical hazards that are encountered during site work are slip, trip and fall. The SSHP shall address exposure to safety hazards in accordance with EM 385-1-1.

1.9.2.4 Radiological Hazards

There is no known radiation hazard in this project.

1.9.2.5 Biological Hazards

Potential biological hazards are insects such as ants in hot weather.

1.9.3 Action Levels

1.9.3.1 General Requirements

Action levels shall be established for the situations listed below, at a minimum. The action levels and required actions (engineering controls, changes in PPE, etc.) shall be presented in the SSHP in both text and tabular form.

- a. Implementation of engineering controls and work practices.

- b. Upgrade or downgrade in level of personal protective equipment.
- c. Work stoppage and/or emergency evacuation of onsite personnel.
- d. Prevention and/or minimization of public exposures to hazards created by site activities.

1.9.3.2 Confined Space Entry

Entry into and work in a confined space will not be allowed when oxygen readings are less than 19.5% or greater than 23.5% or if the Lower Flammable Limit (LFL) reading is greater than 10%, unless these conditions are adequately addressed in the Permit Required Confined Space Program. In addition, action levels for toxic atmospheres shall be determined.

1.10 ACTIVITY HAZARD ANALYSES

Prior to beginning each major phase of work, an Activity Hazard Analysis shall be prepared by the Contractor performing that work and submitted for review and acceptance. The format shall be in accordance with EM 385-1-1, Section 1, Figure 1-1. A major phase of work is defined as an operation involving a type of work presenting hazards not experienced in previous operations or where a new subcontractor or work crew is to perform. The analysis shall define the activities to be performed and identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the activity hazard analysis has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the government onsite representatives. The activity hazard analyses shall be continuously reviewed and when appropriate modified to address changing site conditions or operations, with the concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Activity hazard analyses shall be attached to and become a part of the SSHP.

1.11 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

An organizational structure shall be developed that sets forth lines of authority (chain of command), responsibilities, and communication procedures concerning site safety, health, and emergency response. This organizational structure shall cover management, supervisors and employees of the Contractor and subcontractors. The structure shall include the means for coordinating and controlling work activities of subcontractors and suppliers. The SSHP shall include a description of this organizational structure as well as qualifications and responsibilities of each of the following individuals. The Contractor shall obtain Contracting Officer's acceptance before replacing any member of the Safety and Health Staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement.

1.11.1 Site Superintendent

A Site Superintendent, who has responsibility to implement the SSHP, the authority to direct work performed under this contract and verify compliance, shall be designated.

1.11.2 Safety and Health Manager

1.11.2.1 Qualifications

The services of an Industrial Hygienist certified by the American Board of

Industrial Hygiene or a safety professional certified by the Board of Certified Safety Professionals shall be utilized. The name, qualifications (education summary and documentation, ABIH or BCSP certificate), and work experience summary shall be included in the SSHP. The Safety and Health Manager shall have the following additional qualifications:

- a. A minimum of 2 years experience in developing and implementing safety and health programs at underground storage tank removal projects.
- b. Documented experience in supervising professional and technician level personnel.
- c. Documented experience in developing worker exposure assessment programs and air monitoring programs and techniques.
- d. Documented experience in the development of personal protective equipment programs, including programs for working in and around potentially toxic, flammable and combustible atmospheres and confined spaces.
- e. Working knowledge of state and Federal occupational safety and health regulations.

1.11.2.2 Responsibilities

The Safety and Health Manager shall:

- a. Be responsible for the development, implementation, oversight, and enforcement of the SSHP.
- b. Sign and date the SSHP prior to submittal.
- c. Conduct initial site-specific training.
- d. Be present onsite during the first 2 days of activities and at the startup of each new major phase.
- e. Visit the site as needed and at least once per month for the duration of activities, to audit the effectiveness of the SSHP.
- f. Be available for emergencies.
- g. Provide onsite consultation as needed to ensure the SSHP is fully implemented.
- h. Coordinate any modifications to the SSHP with the Site Superintendent, the SSHO, and the Contracting Officer Representative (COR).
- i. Provide continued support for upgrading/downgrading of the level of personal protection.
- j. Be responsible for evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.
- k. Review accident reports and results of daily inspections.
- l. Serve as a member of the Contractor's quality control staff.

1.11.3 Site Safety and Health Officer (SSHO)

1.11.3.1 Qualifications of SSHO

An individual shall be designated the Site Safety and Health Officer (SSHO). The name, qualifications (education and training summary and documentation), and work experience of the Site Safety and Health Officer shall be included in the SSHP. The SSHO shall have the following qualifications:

- a. A minimum of 2 years experience in implementing safety and health programs at underground storage tank removal projects where Level B personal protective equipment was required.
- b. Documented experience in construction techniques and construction safety procedures.
- c. Working knowledge of Federal and state occupational safety and health regulations.
- d. Specific training in personal and respiratory protective equipment program implementation, confined space program oversight, and in the proper use of air monitoring instruments, and air sampling methods.

1.11.3.2 Responsibilities of SSHO

The Site Safety and Health Officer shall:

- a. Assist and represent the Safety and Health Manager in onsite training and the onsite implementation and enforcement of the accepted SSHP.
- b. Be assigned to the site on a full time basis for the duration of HTRW/UST work. The SSHO shall have no duties other than Safety and Health related duties. If operations are performed during more than 1 work shift per day, a site Safety and Health Officer shall be present for each shift.
- c. Have authority to ensure site compliance with specified safety and health requirements, Federal, state and OSHA regulations and all aspects of the SSHP including, but not limited to, activity hazard analyses, air monitoring, monitoring for ionizing radiation, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, confined space entry procedures, spill containment program, and preparation of records by performing a daily safety and health inspection and documenting results on the Daily Safety Inspection Log.
- d. Have authority to stop work if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.
- e. Consult with and coordinate any modifications to the SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer.
- f. Serve as a member of the Contractor's quality control staff on matters relating to safety and health.
- g. Conduct accident investigations and prepare accident reports.
- h. Review results of daily quality control inspections and document safety and health findings into the Daily Safety Inspection Log.
- i. In coordination with site management and the Safety and Health Manager, recommend corrective actions for identified deficiencies and oversee the corrective actions.

1.11.4 Occupational Physician (OP)

1.11.4.1 Qualifications of OP

The services of a licensed physician, who is certified in occupational medicine by the American Board of Preventative Medicine, or who, by necessary training and experience is Board eligible, shall be utilized. The physician shall be familiar with this site's hazards and the scope of this project. The medical consultant's name, qualifications, and knowledge of the site's conditions and proposed activities shall be included in the SSHP.

1.11.4.2 Responsibilities of OP

The physician shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1910, Section .120 (f) and 29 CFR 1926, Section .65 (f) and paragraph MEDICAL SURVEILLANCE.

1.11.5 Persons Certified in First Aid and CPR

At least two persons who are currently certified in first aid and CPR by the American Red Cross or other approved agency shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section .1030. These persons may perform other duties but shall be immediately available to render first aid when needed.

1.11.6 Safety and Health Technicians

For each work crew in the exclusion zone, one person, designated as a Safety and Health technician, shall perform activities such as air monitoring, decontamination, and safety oversight on behalf of the SSHO. They shall have appropriate training equivalent to the SSHO in each specific area for which they have responsibility and shall report to and be under the supervision of the SSHO.

1.11.7 Not Used

1.11.8 Not Used

1.12 TRAINING

Personnel shall receive training in accordance with the Contractor's written safety and health training program and 29 CFR 1910 Section .120, 29 CFR 1926 Section .65, and 29 CFR 1926 Section .21. The SSHP shall include a section describing training requirements.

1.12.1 General Hazardous Waste Operations Training

Personnel entering the exclusion or contamination reduction zones shall have successfully completed 40 hours of hazardous waste instruction off the site; 3 days actual field experience under the direct supervision of a trained, experienced supervisor; and 8 hours refresher training annually. Onsite supervisors shall have completed the above training and 8 hours of additional, specialized training covering at least the following topics: the employer's safety and health program, personal protective equipment program, spill containment program, and health hazard monitoring procedures and techniques. Copies of current training certification statements shall be submitted prior to initial entry onto the work site.

1.12.2 Site-specific Training

Site-specific training sessions shall be documented in accordance with Section 01.B.03.b of EM 385-1-1.

1.12.2.1 Initial Session (Pre-entry Briefing)

Prior to commencement of onsite field activities, all site employees, including those assigned only to the Support Zone, shall attend a site-specific safety and health training session of at least 4 hours duration. This session shall be conducted by the Safety and Health Manager and the Site Safety and Health Officer to ensure that all personnel are familiar with requirements and responsibilities for maintaining a safe and healthful work environment. Procedures and contents of the accepted SSHP and Sections 01.B.02 and 28.D.03 of EM 385-1-1 shall be thoroughly discussed. The Contracting Officer shall be notified at least 5 days prior to the initial site-specific training session so government personnel involved in the project may attend.

1.12.2.2 Periodic Sessions

Periodic onsite training shall be conducted by the SSHO under the direction of the Safety and Health Manager at least weekly for personnel assigned to work at the site during the following week. The training shall address safety and health procedures, work practices, any changes in the SSHP, activity hazard analyses, work tasks, or schedule; results of previous week's air monitoring, review of safety discrepancies and accidents. Should an operational change affecting onsite field work be made, a meeting prior to implementation of the change shall be convened to explain safety and health procedures. Site-specific training sessions for new personnel, visitors, and suppliers shall be conducted by the SSHO using the training curriculum outlines developed by the Safety and Health Manager.

1.12.2.3 Not Used

1.13 PERSONAL PROTECTIVE EQUIPMENT

1.13.1 PPE Program

In accordance with 29 CFR 1910 Section .120 (g)(5) and 29 CFR 1926 Section .65 (g)(5), a written Personal Protective Equipment (PPE) program which addresses the elements listed in that regulation, and which complies with respiratory protection program requirements of 29 CFR 1910 Section .134, is to be included in the employer's Safety and Health Program. The Site Safety and Health Plan shall detail the minimum PPE ensembles (including respirators) and specific materials from which the PPE components are constructed for each site-specific task and operation to be performed, based upon the hazard/risk analysis. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions, including heat and cold stress potential and safety hazards. Only respirators approved by NIOSH shall be used. Onsite personnel shall be provided with appropriate personal protective equipment. Protective equipment and clothing shall be kept clean and well maintained. The PPE section of the SSHP shall include site-specific procedures to determine PPE program effectiveness and for onsite fit-testing of respirators, cleaning, maintenance, inspection, and storage of PPE.

1.13.2 Levels of Protection

The Safety and Health Manager shall establish appropriate levels of protection for each work activity based on review of site information, analytical data, an evaluation of the potential for exposure (inhalation, dermal, ingestion, and injection) during each task, initial air monitoring

results, and a continuing safety and health monitoring program. The Safety and Health Manager shall also establish action levels for upgrade or downgrade in levels of PPE from the following specified minimum levels of protection. Protocols and the communication network for changing the level of protection shall be described in the SSHP. The PPE reassessment protocol shall address air monitoring results, potential for exposure, changes in site conditions, work phases, job tasks, weather, temperature extremes, individual medical considerations, etc.

1.13.2.1 Components of Levels of Protection

The following items constitute minimum protective clothing and equipment ensembles to be utilized during this project:

Level D.

1.13.2.2 Initial Minimum Levels of PPE by Task

The Contractor shall establish the initial minimum protective equipment requirements for each major task and operation in the format as detailed below. Available site information shall be reviewed and the list of tasks and operations and these levels of protection shall be expanded and/or revised during preparation of the SSHP, after analytical results are available, or after site evaluation.

MINIMUM PROTECTIVE EQUIPMENT REQUIREMENTS

TASK/OPERATION

INITIAL LEVEL OF PROTECTION

1.13.3 PPE for Government Personnel

One clean set of personal protective equipment for work onsite and clothing (excluding air-purifying negative-pressure respirators and safety shoes, which will be provided by individual visitors), as required for entry into the Exclusion Zone and/or Contamination Reduction Zone, shall be available for use by the Contracting Officer or official visitors. The items shall be cleaned and maintained by the Contractor and stored in the clean room of the decontamination facility and clearly marked: "FOR USE BY GOVERNMENT ONLY." The Contractor shall provide basic training in the use and limitations of the PPE provided, and institute administrative controls to check prerequisites prior to issuance. Such prerequisites include meeting minimum training requirements for the work tasks to be performed and medical clearance for site hazards and respirator use.

1.14 MEDICAL SURVEILLANCE

The Safety and Health Manager, in conjunction with the Occupational Physician, shall detail, in the employer's Safety and Health Program and the SSHP, the medical surveillance program that includes scheduling of examinations, certification of fitness for duty, compliance with OSHA requirements, and information provided to the physician. Examinations shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place. Medical surveillance protocols and examination and test results shall be reviewed by the Occupational Physician. The medical surveillance program shall contain the requirements specified below. Personnel working in contaminated areas of the site shall have been examined as prescribed in 29 CFR 1910 Section .120, and 29 CFR 1926 Section .65, and determined medically fit to perform their duties.

1.14.1 Frequency of Examinations

Employees shall have been provided with medical examinations as specified, within the past 12 months and shall receive exams annually thereafter (if contract duration exceeds 1 year); on termination of employment; reassignment in accordance with 29 CFR 1910 Section .120 (f)(3)(i), and 29 CFR 1926 Section .65 (f)(3)(i)(C); if the employee develops signs or symptoms of illness related to workplace exposures; if the physician determines examinations need to be conducted more often than once a year; and when an employee develops a lost time injury or illness during the period of this contract. The supervisor shall be provided with a written statement signed by the physician prior to allowing the employee to return to the work site after injury or illness resulting in a lost workday, as defined in 29 CFR 1904 Section .12 (f).

1.14.2 Content of Examinations

The following elements shall be included in the medical surveillance program. Additional elements may be included at the discretion of the occupational physician responsible for reviewing the medical surveillance protocols.

- a. Complete medical and occupational history (initial exam only).

- b. General physical examination of major organ systems.
- c. Pulmonary function testing including FVC and FEV1.0.
- d. CBC with differential.
- e. Blood chemistry screening profile (e.g. SMAC 20/25).
- f. Urinalysis with microscopic examination.
- g. Audiometric testing (as required by Hearing Conservation Program).
- h. Visual acuity.
- i. Chest x-ray. (This test shall be performed no more frequently than every 4 years, unless directed by Occupational Physician.)
- j. Electrocardiogram (as directed by Occupational Physician).
- k. Urine heavy metals (arsenic, cadmium, chromium, and mercury).
- l. serum lead.
- m. zinc protoporphyrin.

1.14.3 Information Provided to the Occupational Physician

The physician shall be furnished with the following:

- a. Site information from paragraph, SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION and info from Section 02115 - HYDRANT FUELING SYSTEM REMOVAL.
- b. information on the employee's anticipated or measured exposure.
- c. a description of any PPE used or to be used.
- d. A description of the employee's duties as they relate to the employee's exposures (including physical demands on the employee and heat/cold stress).
- e. A copy of 29 CFR 1910 Section .120, or 29 CFR 1926 Section .65.
- f. Information from previous examinations not readily available to the examining physician.
- g. A copy of Section 5.0 of NIOSH Pub No. 85-115.
- h. Information required by 29 CFR 1910 Section .134.

1.14.4 Physician's Written Opinion

Before work begins a copy of the physician's written opinion for each employee shall be obtained and furnished to the Safety and Health Manager; and the employee. The opinion shall address the employee's ability to perform remediation work and shall contain the following:

- a. The physician's recommended limitations upon the employee's assigned work and/or PPE usage.
- b. The physician's opinion about increased risk to the employee's health resulting from work; and

c. A statement that the employee has been informed and advised about the results of the examination.

1.14.5 Medical Records

Documentation of medical exams shall be provided as part of the Certificate of Worker or Visitor Acknowledgment. Medical records shall be maintained in accordance with 29 CFR 1910 Section .120, and 29 CFR 1926 Section .65.

1.15 NOT USED

1.15.1 [Enter Appropriate Subpart Title Here]

1.16 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

The Safety and Health Manager shall prepare and implement an exposure monitoring/air sampling program to identify and quantify safety and health hazards and airborne levels of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment for affected site personnel. Available site information shall be reviewed and the exposure monitoring/air sampling program shall be expanded and/or revised for submittal as part of the SSHP.

1.17 HEAT AND COLD STRESS MONITORING

The Safety and Health Manager shall develop a heat stress and cold stress monitoring program for onsite activities. Details of the monitoring program, including schedules for work and rest, and physiological monitoring requirements, shall be described in the SSHP. Personnel shall be trained to recognize the symptoms of heat and cold stress. The SSHP and an alternate person shall be designated, in writing, to be responsible for the heat and cold stress monitoring program.

1.17.1 Heat Stress

Physiological monitoring shall commence when the ambient temperature is above 70 degrees F. Monitoring frequency shall increase as the ambient temperature increases or as slow recovery rates are observed. An adequate supply of cool drinking water shall be provided for the workers. NIOSH Pub No. 85-115 may be consulted for guidance in determining protocols for prevention of heat stress.

1.17.2 Cold Stress

To guard against cold injury, appropriate clothing and warm shelter for rest periods shall be provided. Procedures to monitor and avoid cold stress shall be followed in accordance with the current TLVs for Cold Stress as recommended in ACGIH Threshold Limits.

1.18 SAFETY PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES

The SSHP shall describe the standard operating safety procedures, engineering controls and safe work practices to be implemented for the work covered. These shall include, but not be limited to, the following:

1.18.1 General Site Rules/Prohibitions

The plan shall discuss general site rules/prohibitions (buddy system, eating, drinking, and smoking restrictions, etc.)

1.18.2 Work Permit Requirements

The Contractor shall be responsible to obtain excavation, hot work, confined space permit (if entry is justified). Contaminated water in the hydrant fuel pits can be pumped off without entry. If entry is required, the Contractor shall justified work with Contracting Officer (see requirement in paragraph, Description of Work).

1.18.3 Material Handling Procedures

Soils and liquids.

1.18.3.1 Spill and Discharge Control

Written spill and discharge containment/control procedures shall be developed and implemented in accordance with approved Work Plan per Section 02115 - Hydrant Fueling System Removal (paragraph 1.6.2). These procedures shall address material handling equipment, and appropriate procedures for drum and container handling, opening, sampling, shipping and transport. These procedures shall describe prevention measures, such as building berms or dikes; spill control measures and material to be used (e.g. booms, vermiculite); location of the spill control material; personal protective equipment required to cleanup spills; disposal of contaminated material; and who is responsible to report the spill. Storage of contaminated material or hazardous materials shall be appropriately bermed, diked and/or contained to prevent any spillage of material on uncontaminated soil. If the spill or discharge is reportable, and/or human health or the environment are threatened, the National Response Center, the state, and the Contracting Officer shall be notified as soon as possible. Reporting requirements shall be in accordance with Section 02115 - HYDRANT FUELING SYSTEM REMOVAL.

1.18.3.2 Materials Transfer Safety

Liquids and residues shall be removed from the fuel lines, hydrant fuel pits and valve boxes using explosion-proof or air-driven pumps. Pump motors and suction hoses shall be bonded to the metallic items being pumped and grounded to prevent electrostatic ignition hazards. Use of a hand pump will be permitted to remove the last of the liquid from the bottom of the metallic items. If a vacuum truck is used for removal of liquids or residues, the area of operation for the vacuum truck shall be vapor free. The truck shall be located upwind from the metallic items being pumped and outside the path of probable vapor travel. The vacuum pump exhaust gases shall be discharged through a hose of adequate size and length downwind of the truck and metallic items being pumped. Vacuum truck operating and safety practices shall conform to API Publ 2219. Pumped residues shall be collected in drums, tanks, or tank trucks labeled according to 49 CFR 171 and 49 CFR 172 and disposed of as specified. After the materials have been transferred and the valve boxes, manholes or hydrant fuel pits have been exposed, fittings and lines leading to these units shall be disconnected and drained of their contents. The contents of the fuel pipes shall not spill to the environment during cutting or disconnecting of fittings. Materials drained shall be transferred into DOT-approved drums for storage and/or transportation. Only non-sparking or non-heat producing tools shall be used to disconnect and drain or to cut through fittings. Electrical equipment (e.g., pumps, portable hand tools, etc.) used for preparation of these mettalic items shall be explosion-proof.

1.18.4 Drum and Container Handling

Procedures and Precautions (opening, sampling, overpacking) shall be identified in the Work Plan per Section 02115.

1.18.5 Confined Space Entry Procedures

No confined space entry is known for this project, the Contractor shall verify onsite and discuss this issue with the COR during Preconstruction conference (see paragraph, Description of Work).

1.18.6 Hot Work

Hot work will not be permitted on or within the hydrant fueling system (pipes, pits, valve boxes) except as outlined herein. Prior to conducting hot work, a hot work permit shall be prepared and submitted. An example format for a hot work permit shall be included in the SSHP. The permit shall describe compliance with the following procedures. After interiors of mettalic items have been decontaminated, hot work may be conducted only when these items are inerted, and to the extent necessary to begin dismantling. After decontamination of interiors of metallic items, hot work shall not be performed unless monitoring indicates atmospheres within and immediately surrounding these metallic items are less than 8% oxygen inside the item and less than 10% of the LFL outside the item; continuous monitoring shall continue until the hot work is completed. The hot work prohibition includes welding, cutting, grinding, sawing, or other similar operations which could be expected to potentially generate combustion-producing temperatures or sparks, or which could produce potentially hazardous fumes or vapors. An individual at each hot work site shall be designated as a fire watch. This person's sole responsibility shall be to monitor the hot work and have immediate access to the fire extinguisher located at each hot work site. A new permit shall be obtained at the start of each work shift during which hot work will be conducted.

1.18.7 Ignition Sources

1.18.8 Fire Protection and Prevention

1.18.9 Electrical Safety

1.18.10 Excavation, Shoring, and Trench Safety

1.18.11 Guarding of Machinery and Equipment

1.18.12 Lockout/Tagout

1.18.13 Fall Protection

1.18.14 Hazard Communication

1.18.15 Illumination

1.18.16 Sanitation

1.18.17 Engineering Controls

1.18.18 Process Safety Management

1.18.19 Signs and Labels

1.18.20 Waste Disposal

1.18.21 Purging for Permit-Required Confined Space Entries

Confined space entry into the pits shall not be attempted unless absolutely

necessary. Confined space entry shall be concurred by both the COR and the Safety and Health Manager in written agreement. If confined space entry is attempted, the flammable vapors shall be reduced to less than 10% of the LFL and the oxygen content shall be between 19.5% and 23.5%. Flammable vapors may be exhausted from the metallic items by any of the methods from API RP 1604 listed below, or any method approved by the Contracting Officer. The SSHP shall specify the purging method to be used.

a. Ventilation by Eductor-Type Air Movers: The eductor-type air mover shall be properly bonded and grounded to prevent the generation and discharge of static electricity. When using this method, the fill (drop) tube shall remain in place to ensure ventilation at the bottom of the metallic items. An eductor extension shall be used to discharge vapors a minimum of 12 feet above grade or 3 feet above adjacent roof lines, whichever is greater. If this is not possible, alternative methods shall be proposed and approved prior to purging. Noise levels generated by these devices as a result of high airflow may exceed OSHA PELs. Noise levels shall be evaluated and appropriate hearing protection shall be provided.

b. Ventilation by Diffused Air Blowers: When using this purging method, the air-diffusing pipe is properly bonded and grounded to prevent the discharge of a spark. Fill (drop) tubes shall be removed to allow proper diffusion of the air in the tank. Air supply shall be from a compressor that has been checked to ensure that Grade D breathing air is being supplied. Air pressure in the tank shall not exceed 5 psi gauge to avoid tank failure.

c. Commercial Emulsifiers and Volatile Fuel Encapsulators: These products are completely miscible in water, aid in the elimination of flammable vapors, and are biodegradable. Regulatory requirements for treatment and disposal of the water shall be determined prior to using this method. Standing outside the tank, the operator shall rinse the tank with a 3-to-6 percent solution of the product using a pressure sprayer through a tank opening. Explosive concentrations shall be measured at several levels (top, middle, and bottom) within the tank. If readings are greater than 10% of the LFL, the tank shall be rinsed again. When LFL readings are acceptable, the water in the tank shall be pumped out for disposal.

1.18.22 Inerting (No Entry)

Following the removal of contents from metallic items but prior to excavation and preparation activities, the metallic items shall be inerted only by introducing an inert gas, carbon dioxide (CO₂) or liquid nitrogen (N₂), to remove flammable vapors. Before inerting, all openings shall be plugged with threaded or expansion type plugs except the ventilation area and the opening to be used for introducing the inert gas. Within 30 minutes prior to initiating any activities (e.g., excavating, preparation, removal, opening, demolition, transportation, or other similar activities) involving metallic items which has been inerted, the inerted nature of the metallic items (oxygen levels less than 8%) shall be verified.

a. CO₂ fire extinguishers shall not be used for inerting the interiors of the metallic items. If a compressed gas (e.g., CO₂ or N₂) is introduced into the tank the following requirements shall be met to prevent the buildup of static electricity:

(1) The metallic items and the compressed gas supply tank shall be bonded together and grounded.

(2) The compressed gas shall be supplied only at low flows.

(3) The liquid or gas shall be released at the bottom of the

metallic items so that static electricity is not generated by liquid falling to the bottom of the item. The item shall be slowly filled from the bottom up.

b. Dry ice, which evolves CO₂ gas as it evaporates, if used, shall be introduced in the amount of at least 3 pounds per 100 gallons of the container's capacity. Skin contact with dry ice shall be prevented by wearing heavy cloth gloves.

c. Sufficient quantities of inert gas (CO₂ or N₂) shall be introduced into the metallic items to lower the oxygen content to less than 8%. Pressure inside the tank shall not exceed 5 psi. Prior to proceeding with additional activities on the tank (e.g., excavating), the oxygen content of the tanks shall be monitored to confirm that it is less than 8%. Additional oxygen level monitoring shall be conducted at least hourly while activities involving the metallic items are underway but prior to decontamination of the interiors; at least daily during periods in which the metallic items are not being disturbed but prior to decontamination of their interiors; or as directed by the Contracting Officer. If monitoring of interiors indicates that oxygen levels are not remaining below 8%, additional inert gas shall be introduced and more frequent oxygen monitoring shall be initiated.

d. During inerting procedures, an extension vent tube a minimum of 12 feet above grade or 3 feet above any adjacent (within 75 feet) roof lines, whichever is greater shall be used to discharge vapors from the metallic items. If this is not possible, alternative methods shall be proposed and approved prior to inerting. Continuous combustible gas/oxygen monitoring shall be conducted at the vent and inert gas introduction holes.

1.18.23 Atmosphere Testing

The air within the metallic items shall be monitored to ensure the space is either adequately purged and safe for personnel entry, or to ensure it has been adequately inerted and the oxygen content is less than 8%. In both instances, monitoring shall be performed at the top, bottom, and middle areas of the metallic items to ensure stratification has not occurred. Monitoring results shall be reported to project personnel to ensure safe operations. Data shall be recorded as specified in paragraph EXPOSURE MONITORING/AIR SAMPLING PROGRAM.

1.18.23.1 Monitoring to Ensure Purging

When monitoring to ensure purging, both oxygen content and LFL readings are required. Prior to obtaining LFL readings, the Contractor shall monitor the oxygen content of the space and verify that the combustible gas indicators are operating within the oxygen limits identified by the CGI manufacturer. Personnel shall not be permitted to enter spaces with oxygen levels less than 19.5%, except in emergencies, and then only when equipped with the proper PPE and when following permit-required confined space entry procedures. Toxic air contaminants shall be monitored as specified in paragraph EXPOSURE MONITORING/AIR SAMPLING PROGRAM.

1.18.23.2 Monitoring to Ensure Inerting

Inerted metallic items shall be monitored to ensure oxygen readings remain below a maximum allowable percentage of 8% by volume.

1.18.24 Metallic Items Lifting

Metallic Items shall be lifted using equipment with a rated capacity greater than the load to be lifted. Personnel shall be directed to remain

away from the ends of these metallic items whenever possible, with the ends oriented away from occupied or traveled areas. During transportation, the metallic items shall all be secured to prevent movement.

1.18.25 Dismantling

The excavated metallic items as part of this project shall be dismantled before being removed from the site and transported directly to a state permitted scrap metal facility. Dismantling shall not be performed until a decontamination of the interiors and exteriors (if necessary) is complete. Metallic items shall be inerted and tested before they are taken apart. Plans and procedures, including a list of materials and supplies, for safely and effectively dismantling shall be submitted in the SSHP.

1.18.26 Cleaning

Safety practices and procedures for the cleaning of the metallic items shall conform to API Std 2015. Decontamination shall be conducted utilizing only methods approved in the SSHP. The interior and exterior of the metallic items shall be decontaminated prior to removing it from the work site. Plans and procedures, including materials and supplies, for safely and effectively dismantling, cleaning surfaces of the interior and exterior of metallic items, and disposing of the decontamination fluids shall be submitted in the SSHP. Volatile organic solvents shall not be permitted to be utilized for decontamination procedures. Personnel shall not enter any of the metallic items as a part of this project, except as indicated in signed agreement from both COR and the Safety and Health Manager when following permit-required confined space entry procedures. Decontamination fluids shall be collected, drummed, tested and disposed. Upon completion of this project, written certification shall be made that the demolished existing hydrant fueling system was properly decontaminated prior to being removed from the site.

1.19 SITE CONTROL MEASURES

In order to prevent the spread of contamination and control the flow of personnel, vehicles, and materials into and out of work areas, site control measures shall be established and described in the SSHP. The SSHP shall describe the methodology to be used by the Safety and Health Manager and SSHA in determining work zone designations and their modifications, and procedures to limit the spread of contamination. The SSHP shall include procedures for the implementation and enforcement of safety and health rules for all persons on the site, including employers, employees, outside Contractors, government representatives, and visitors.

1.19.1 Work Zones

Utilizing this guidance, work zone boundaries (exclusion zone, including restricted and regulated areas; contamination reduction zone; and support zone) and access points shall be established and the boundary delineations shall be indicated on the drawings and in the SSHP. Delineation of work zone boundaries shall be based on the contamination characterization data and the hazard/risk analysis to be performed as described in paragraph: HAZARD/RISK ANALYSIS. As work progresses and field conditions are monitored, work zone boundaries may be modified with approval of the Contracting Officer. Work zones shall be clearly identified and marked in the field (using fences, tape, signs, etc.). A site map, showing work zone boundaries and locations of decontamination facilities, shall be posted in the onsite office. Work zones shall consist of the following:

a. Exclusion Zone (EZ): The exclusion zone is the area where hazardous contamination is either known or expected to occur and the

greatest potential for exposure exists. Entry into this area shall be controlled and exit may only be made through the CRZ.

b. Contamination Reduction Zone (CRZ): The CRZ is the transition area between the Exclusion Zone and the Support Zone. The personnel and equipment decontamination areas shall be separate and unique areas located in the CRZ.

c. Support Zone (SZ): The Support Zone is defined as areas of the site, other than exclusion zones and contamination reduction zones, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from hazardous waste operations. The Support Zone shall be secured against active or passive contamination. Site offices, parking areas, and other support facilities shall be located in the Support Zone.

1.19.2 Site Control Log

A log of personnel visiting, entering, or working on the site shall be maintained. The log shall include the following: date, name, agency or company, time entering and exiting site, time entering and exiting the exclusion zone (if applicable), and personal protective equipment utilized.

Before visitors are allowed to enter the Contamination Reduction Zone or Exclusion Zone, they shall show proof of current training, medical surveillance and respirator fit testing (if respirators are required for the tasks to be performed) and shall fill out the Certificate of Worker or Visitor Acknowledgment. This visitor information, including date, shall be recorded in the log.

1.19.3 Communication

An employee alarm system that has adequate means of on and off site communication shall be provided and installed in accordance with 29 CFR 1910 Section .165. The means of communication shall be able to be perceived above ambient noise or light levels by employees in the affected portions of the workplace. The signals shall be distinctive and recognizable as messages to evacuate or to perform critical operations.

1.19.4 Site Security

Signs shall be printed in bold large letters on contrasting backgrounds in English and/or where appropriate, in the predominant language of workers unable to read English. Signs shall be visible from all points where entry might occur and at such distances from the restricted area that employees may read the signs and take necessary protective steps before entering.

1.20 PERSONAL HYGIENE AND DECONTAMINATION

Personnel entering the Exclusion or Contamination Reduction Zones or otherwise exposed or subject to exposure to hazardous chemical vapors, liquids, or contaminated solids shall adhere to the following personal hygiene and decontamination provisions. Decontamination shall be performed in the CRZ prior to entering the Support Zone from the Exclusion Zone. Chapter 10.0 of NIOSH Pub No. 85-115 shall be consulted when preparing decontamination procedures. A detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers shall be submitted as part of the SSHP. Employees shall be trained in the procedures and the procedures shall be enforced throughout site operations.

Persons disregarding these provisions of the SSHP shall be barred from the site.

1.20.1 Decontamination Facilities

The following facilities shall be provided: 1) A personnel decontamination facility in the CRZ. This facility shall be used by both Contractor personnel and government representatives. The decontamination facility shall provide for separation of street clothing and contaminated PPE and shall be equipped with heating, lighting, ventilation, a change room and lockers, hot and cold water, shower facilities with hot and cold water, towels, soap in sufficient quantities for all anticipated personnel, and waste water storage facilities for controlling the disposal of used water. 2) Laundry facilities or provisions of laundry service. If an offsite laundry service is used, they shall be notified, in writing, of the possibility and nature of contaminants expected on clothing.

1.20.2 Procedures

Minimum decontamination procedures are listed below. Available site information shall be reviewed and these procedures shall be expanded and/or revised for submittal as part of the SSHP.

1.21 EQUIPMENT DECONTAMINATION

Vehicles and equipment used in the EZ shall be decontaminated in the CRZ prior to leaving the site. The procedures for decontamination of vehicles and equipment shall be addressed in the SSHP.

1.21.1 Decontamination Facilities

A equipment decontamination station shall be provided within the CRZ for decontaminating equipment leaving the EZ. The decontamination station shall include the following: A traffic surface consisting of a minimum of 12 inches of crushed rock. The crushed rock shall be underlaid by a chemically resistant impermeable flexible membrane, such as HDPE, PVC or VLDPE with a minimum thickness of 40 mils. The liner shall be protected from damage on top with a geotextile. The base layer of soil on which the membrane is placed shall be free of objects greater than 0.375 inches in diameter and any other materials which could puncture or damage the membrane.

The pad shall be constructed to capture decontamination water, including overspray, and shall allow for collection and removal of the decontamination water using sumps, dikes and ditches as required. High pressure, low volume, water wash area for equipment and vehicles. A designated "clean area" in the CRZ for performing equipment maintenance. This area shall be used when personnel are required by normal practices to come in contact with the ground, i.e., crawling under a vehicle to change engine oil. Equipment within the EZ or CRZ shall be decontaminated before maintenance is performed.

1.21.2 Procedures

Procedures for equipment decontamination shall be developed and utilized to prevent the spread of contamination into the SZ and offsite areas. These procedures shall address disposal of contaminated products and spent materials used on the site, including containers, fluids, oils, etc. Any item taken into the EZ shall be assumed to be contaminated and shall be inspected and/or decontaminated before the item leaves the area. Vehicles, equipment, and materials shall be cleaned and decontaminated prior to leaving the site. Construction material shall be handled in such a way as to minimize the potential for contaminants being spread and/or carried offsite. Prior to exiting the site, vehicles and equipment shall be monitored to ensure the adequacy of decontamination.

1.22 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

The SSHP shall describe the emergency and first aid equipment to be available onsite. The following items, as a minimum, shall be maintained onsite and available for immediate use:

- a. First aid equipment and supplies approved by the consulting physician.
- b. Emergency eyewashes and showers which comply with ANSI Z358.1.
- c. Emergency-use respirators. For escape purposes, 5- to 15-minute emergency escape masks shall be supplied. For rescue purposes, 2 positive pressure self-contained breathing apparatus (SCBA) shall be supplied. These shall be dedicated for emergency use only and maintained onsite in the Contamination Reduction Zone.
- d. Fire extinguishers with a minimum rating of 20-A:120-B:C shall be provided at site facilities and in all vehicles and at any other site locations where flammable or combustible materials present a fire risk.

1.23 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

An Emergency Response Plan, that meets the requirements of 29 CFR 1910 Section .120 (1) and 29 CFR 1926 Section .65 (1), shall be developed and implemented as a section of the SSHP. In the event of any emergency associated with remedial action, the Contractor shall, without delay, alert all onsite employees that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Contracting Officer; and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency. Employees that are required to respond to hazardous emergency situations shall be trained in how to respond to such expected emergencies. The plan shall be rehearsed regularly as part of the overall training program for site operations. The plan shall be reviewed periodically and revised as necessary to reflect new or changing site conditions or information. Copies of the accepted SSHP and revisions shall be provided to the affected local emergency response agencies. The following elements, as a minimum, shall be addressed in the plan:

- a. Pre-emergency planning. The local emergency response agencies shall be contacted and met with during preparation of the Emergency Response Plan. Agencies to be contacted include local fire, police, and rescue authorities with jurisdiction and nearby medical facilities that may be utilized for emergency treatment of injured personnel. At these meetings, the agencies shall be notified of upcoming site activities and potential emergency situations. The response agencies' capabilities shall be ascertained and written response commitments obtained. The Contractor shall ensure the Emergency Response Plan for the site is compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and Federal agencies.
- b. Personnel roles, lines of authority, communications for emergencies.
- c. Emergency recognition and prevention.
- d. Site topography, layout, and prevailing weather conditions.
- e. Criteria and procedures for site evacuation (emergency alerting procedures, employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).
- f. Specific procedures for decontamination and medical treatment of

injured personnel.

g. Route maps to nearest prenotified medical facility. Site-support vehicles shall be equipped with maps. At the beginning of project operations, drivers of the support vehicles shall become familiar with the emergency route and the travel time required.

h. Emergency alerting and response procedures including posted instructions and a list of names and telephone numbers of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, Federal, state, and local environmental agencies; as well as Safety and Health Manager, the Site Superintendent, the Contracting Officer and/or their alternates).

i. Criteria for initiating community alert program, contacts, and responsibilities.

j. Procedures for reporting incidents to appropriate government agencies. In the event that an incident such as an explosion or fire, or a spill or release of toxic materials occurs during the course of the project, the appropriate government agencies shall be immediately notified. In addition, the Contracting Officer shall be verbally notified immediately and receive a written notification within 24 hours. The report shall include the following items:

- (1) Name, organization, telephone number, and location of the Contractor.
- (2) Name and title of the person(s) reporting.
- (3) Date and time of the incident.
- (4) Location of the incident, i.e., site location, facility name.
- (5) Brief summary of the incident giving pertinent details including type of operation ongoing at the time of the incident.
- (6) Cause of the incident, if known.
- (7) Casualties (fatalities, disabling injuries).
- (8) Details of any existing chemical hazard or contamination.
- (9) Estimated property damage, if applicable.
- (10) Nature of damage, effect on contract schedule.
- (11) Action taken to ensure safety and security.
- (12) Other damage or injuries sustained, public or private.

k. Procedures for critique of emergency responses and follow-up.

1.24 CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGEMENT

A copy of a Contractor-generated certificate of worker/visitor acknowledgement shall be completed and submitted for each visitor allowed to enter contamination reduction or exclusion zones, and for each employee, following the example certificate at the end of this section.

1.25 INSPECTIONS

The SSHO shall perform daily inspections of the jobsite and the work in progress to ensure compliance with EM 385-1-1, the Safety and Health Program, the SSHP and other occupational health and safety requirements of the contract, and to determine the effectiveness of the SSHP. Procedures for correcting deficiencies (including actions, timetable and responsibilities) shall be described in the SSHP. Follow-up inspections to ensure correction of deficiencies shall be conducted and documented. Daily safety inspection logs shall be used to document the inspections, noting safety and health deficiencies, deficiencies in the effectiveness of the SSHP, and corrective actions taken. The SSHO's Daily Inspection Logs shall be attached to and submitted with the Daily Quality Control reports. Each entry shall include the following: date, work area checked, employees present in work area, PPE and work equipment being used in each area, special safety and health issues and notes, and signature of preparer. In the event of an accident, the Contracting Officer shall be notified according to EM 385-1-1. Within 2 working days of any reportable accident, an Accident Report shall be completed on ENG Form 3394 and submitted.

1.26 SAFETY AND HEALTH PHASE-OUT REPORT

A Safety and Health Phase-Out Report shall be submitted within 10 working days following completion of the work, prior to final acceptance of the work. The following minimum information shall be included:

- a. Summary of the overall performance of safety and health (accidents or incidents including near misses, unusual events, lessons learned, etc.).
- b. Final decontamination documentation including procedures and techniques used to decontaminate equipment, vehicles, and on site facilities.
- c. Summary of exposure monitoring and air sampling accomplished during the project.
- d. Signatures of Safety and Health Manager and SSHO.

EXAMPLE CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGMENT

PROJECT NAME CONTRACT NO.
PROJECT ADDRESS
CONTRACTOR'S NAME
[EMPLOYEE'S][VISITOR'S] NAME

The contract for the above project requires the following: that you be provided with and complete formal and site-specific training; that you be supplied with proper personal protective equipment including respirators; that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you.

I HAVE READ, UNDERSTAND AND AGREE TO FOLLOW THE SITE SAFETY AND HEALTH PLAN FOR THIS SITE.

Name Date

FORMAL TRAINING: I have completed the following formal training courses that meet OSHA's requirements:

Date Completed

40 hour:
8 hour supervisory:.....
8 hour refresher:.....

SITE-SPECIFIC TRAINING: I have been provided and have completed the site-specific training required by this Contract. The Site Safety and Health Officer conducted the training. _____

RESPIRATORY PROTECTION: I have been trained in accordance with the criteria in [the Contractor's] [my Employer's] Respiratory Protection program. I have been trained in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair policy. _____

RESPIRATOR FIT-TEST TRAINING: I have been trained in the proper selection, fit, use, care, cleaning, and maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in [the Contractor's] [my employer's] Respiratory Program and have received a satisfactory fit. [I have been assigned my individual respirator.] I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time. _____

MEDICAL EXAMINATION: I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests and may have included an evaluation of a chest ax-ray. A physician made determination regarding my physical capacity to perform work tasks on the project while wearing protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's industrial hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

were no limitations to performing the required work tasks;

were identified physical limitations to performing the required work tasks.

Date medical exam completed

[Employee's][Visitor's] Signature _____
Date _____

Printed Name _____

Social Security Number _____

Contractor's Site Safety and Health Officer Signature _____

Date _____

Printed Name _____

Social Security Number _____

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

[AM#2] _____ BASIC STORM WATER POLLUTION PREVENTION PLAN
05/2003
AMENDMENT #0002

1.1 REFERENCES

40 CFR 110

Protection of Environment: Subchapter
D--WATER PROGRAMS, Discharge of Oil

This Section provides a Basic Storm Water Pollution Prevention Plan (SWPPP) that meets the [National Pollutant Discharge Elimination System (NPDES) Texas Pollutant Discharge Elimination System (TPDES)[AM#2] _____ General Permit]. Both the Government and the Contractor meets the definition of operator for the construction activities. The Government has control over the construction plans and specifications. The Contractor has day-to-day control of field activities to ensure compliance with storm water construction permit. The Government or environmental project designer will prepare a Basic SWPPP. The Contractor shall prepare a field and operation specific SWPPP by meeting requirements in the NPDES TPDES [AM#2] _____ General Permit, this section, and the approved Contractor's SWPPP. [AM#2] Contact for each regulatory agency, a copy of the general permit for storm water discharge during construction, NOI & NOT forms, and instructions are available of the following web sites: [AM#2] _____

http://www.tnrc.state.tx.us/permitting/waterperm/wwperm/tpdestorm.html ([AM#2] PERMIT NO. TXR 150000 for large or small construction site)
[AM#2]

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prepared by the Contractor shall be submitted to the Government for approval prior to submittal of NOI to the regulatory agency. There is no separate payment for work required in this section.

1.2.1 Editable Copy

An editable version of this Section is located on the Contract award CD-ROM disk. It is in the Corps of Engineers' Specsintact software format.

1.3 PROJECT IDENTIFICATION

PROJECT TITLE:[AM#2] Fixed Wing Aircraft Parking Apron Phase II

LOCATION:[AM#2] Ft. Hood, Texas [AM#2] _____

1.4 PROJECT DESCRIPTION

[AM#2] DELETED

The scope of this project includes construction of new [AM#2] buildings, storm sewer, sanitary sewer, parking lots, access drives, sidewalks, lighting, security fence, communication system, and [AM#2] Taxiway rehab. In addition, this project shall include demolition of [AM#2] existing buildings and pavement. The total project area of the new construction site includes off-site material storage, [AM#2] _____ is roughly [AM#2] _____. The total project area of the remote demolition site is roughly [AM#2] 15 acres. The total disturbed area including the new construction and remote demolition sites in this contract is roughly [AM#2] 60 acres.

1.5 Bid Options

There are [AM#2] _____ Bid Options for this project. They are:

[AM#2] Aircraft Parking Apron (MOG #7)

1.6 STANDARD INDUSTRIAL CLASSIFICATION (SIC)

[AM#2] DELETED

[AM#2] _____

[AM#2] _____

[AM#2] _____

1542 - General Contractors - Non-Residential Building, other than
Industrial Buildings and Warehouses (i.e. administrative buildings)

[AM#2] _____

[AM#2] _____

[AM#2] _____

1771 - Concrete Work (includes asphalt, i.e. access drives and parking
lots, culvert construction)

[AM#2] _____

4581 - Airports, Flying Fields, and Airport Terminal Services

[AM#2] _____

[AM#2] _____

[AM#2] _____

[AM#2] _____

[AM#2] _____

9711 - National Security (a general category for military facilities)

1.7 LOCATION

[AM#2] DELETED

The new facility project site is within the city boundary of [AM#2] West Ft. Hood and is in [AM#2] Bell County. [AM#2] _____ The new facility project center is located approximately at [AM#2] 31 degrees [AM#2] 2 minutes [AM#2] 15 seconds latitude, [AM#2] 97 degrees [AM#2] 48 minutes [AM#2] 15 seconds longitude. [AM#2] The project site is west of the cantonement area, South of U.S. Highway 190, northeast of Rober Gray Drive. [AM#2] _____.

1.8 RECEIVING WATERS

[AM#2] DELETED

[AM#2] Storm drainage from the airfield will outfall to tributaries of Reece Creek, west of the site. Drainage flows east and southeast to Reece Creek, then south to Lampasas River and eventually into Stillhouse Hollow Lake. [AM#2] _____.

PART 2 SITE DESCRIPTION

2.1 EXISTING CONDITIONS

[AM#2] DELETED

[AM#2] The existing conditions of each project area are depicted in the Survey Control Sheet (sheet C-103). [AM#2] _____.

2.2 FUTURE CONDITIONS

[AM#2] DELETED

[AM#2] After construction, Storm runoff from the Base Operations building will drain southeast to an existing earthen channel at approximate 5% grade.

The new pallet Warehouse and associated pavement will drain southwest to an existing tributary. The drainage runoff will vary from 0.5% on concrete pavement to 20% on existing hillside.

The new aircraft parking apron pavement will drain southwest to an existing tributary. The drainage runoff will vary from 0.5% on concrete pavement to 25% on grass sideslopes. [AM#2] _____.

2.3 CONSTRUCTION PHASING

[AM#2] DELETED

The Contractor shall establish storm water control structures prior to conducting any site disturbing activities. Then subsequent construction activities includes clearing, grubbing, grading, constructing site drainage devices and utilities, foundation, and paving. The Contractor shall maintain temporary and permanent site stabilization at each portion of site in accordance with Section 3.0 EROSION AND SEDIMENT CONTROLS. Storm water control structures shall not be removed after final stabilization and approval of the COR. Final stabilization is established at the disturbed site when a vegetative cover with a density of 70% of the native undisturbed area. It is a Federal and state requirement that the Contractor shall record date of these major construction site activities and dates of stabilization (see paragraph ATTACHMENTS). Construction of this project will start tentatively on [AM#2] October 2003 and will be completed on [AM#2] October 2006.

2.4 SOILS DATA

[AM#2] DELETED

[AM#2] The following soils data are from the Soil Survey of Coryell County, Texas, issued in March 1977, by the United States Department of Agriculture, Soil Conservation Service.

This site contains one soil type. The Topsy-Urban land complex association is characterized by deep and gently sloping land with slopes ranging from 3 to 8 percent, with an average of 4 percent. Typically, the surface layer is dark grayish brown clay loam and is approximately 178 millimeters deep. The subsoil measures approximately 559 mm and is grayish brown clay loam containing calcium carbonate concentrations and shale fragments. The underlying material consists of stratified layers permeability is moderately slow and occurs at the rate of 15 to 51 mm per hour. Availability of water is medium. Runoff is medium to rapid, and erosion is severe. The root zone is easily penetrated by plant roots. Unified soil classification of this soil type is C. Potential for shrink-swell is moderate. Soil reaction (PH) ranges from 7.9 to 8.4.

2.5 DRAWINGS

[AM#2] DELETED

Sheet [AM#2] C-101 PROJECT LOCATION AND VICINITY PLAN

Sheet [AM#2] CA-108 [AM#2] SWPPP PROTECTION PLAN DEPLOYMENT CENTER [AM#2]

Sheet [AM#2] CC-107 [AM#2] SWPPP PROTECTION PLAN BASE OPERATIONS BUILDING [AM#2]

Sheet [AM#2] CE-119, 120 [AM#2] SWPPP PROTECTION PLAN AMMO UPLOAD ROAD

Sheet [AM#2] CH-115, 116 [AM#2] SWPPP PROTECTION PLAN AIRCRAFT PARKING APRON [AM#2]

[AM#2] Sheet C-520 SWPPP PROTECTION PLAN DETAILS

PART 3 EROSION AND SEDIMENT CONTROLS

3.1 TEMPORARY STABILIZATION

[AM#2] DELETED

When construction activities cease for periods longer than 14 days, when there are contract delays in turfing operation and a quick cover is required to prevent erosion, or when seasonal conditions preclude immediate permanent stabilization measures, the Contractor shall provide temporary soil stabilization. The disturbed areas eligible for temporary stabilization consists of all unpaved, graded, and disturbed portions of the site and no further field work is scheduled beyond 14 days. However, if the earth disturbing activities will be resumed in 21 days, temporary stabilization measures are not required to be initiated. [AM#2]

_____.

3.2 PERMANENT STABILIZATION

[AM#2] DELETED

Permanent stabilization on disturbed, unpaved, and graded areas shall be initiated no more than 14 days after construction activities have ceased permanently. Final or permanent stabilization shall be in accordance with specification sections 02300 EARTHWORK, [AM#2] _____ 02919 TOPSOILING, [AM#2] _____ and 02925 [AM#2] _____ ESTABLISHMENT OF TURF.

3.3 SEDIMENT BASIN

[AM#2] DELETED

[AM#2] A temporary sediment basin is not feasible for this project. [AM#2]

_____.

3.4 STRUCTURAL CONTROLS

[AM#2] DELETED

[AM#2] The Contractor shall used structural control details on sheet No. C-520 and other applicable structural controls approved by the Contracting Officer Representative to minimize erosion at each construction area. The Contractor's detailed SWPPP shall identify erosion and sediment control locations and type of structural controls required at each construction area including material borrow, stockpiled, construction entrances and egress, staging, and disposal areas.

3.4.1 Silt Fence

Silt Fence is used for construction site perimeter control. Silt Fence shall not be used in stream or swale. Sediment at 1/3 height of the fence shall be removed. The Contractor shall verify field conditions, inspect integrity, remove accumulated silt, and maintain silt fence.

3.4.2 Straw Bale Dike

Straw Bale Dike is used for perimeter control and around unpaved perimeter of curb and surface inlet, new manhole, and trenched material from utility construction. Straw Bale Dike shall not be used in stream or swale. Straw Bale Dike shall only be used where the effectiveness is required for less than 3 months. Sediment at 1/2 height of the bale barrier shall be removed. The Contractor shall inspect Straw Bale Dike locations and ensure the bales are intact and eliminating sediment from storm runoff.

3.4.3 Stabilized Construction Ingress/Egress

The Contractor shall establish, inspect, and maintain the stabilized construction ingress/egress at the juncture between the unpaved new access road and the existing paved roadway. The Contractor shall determine locations for stabilized construction entrance/egress on the Contractor's field and operation specific SWPPP. The stabilized construction entrance/egress shall be away from waterways. The minimum width and depth of entrance is 15 feet and 20 feet, respectively for site 1 acre or larger.

For sites over 10 acres, the minimum width and depth of entrance is 25 feet and 50 feet, respectively. If possible, small entrance shall be incorporated into small lot construction.

3.4.4 Contractor Staging, Parking, Material Storage, Borrow and Disposal Areas Protection Device

The Contractor shall establish storm water control structures around the staging, parking, material stockpiled areas, borrow and disposal areas [AM#2] _____. A graveled stabilized area or sediment log is acceptable. The Contractor's SWPPP shall show these locations on the vicinity map and/or site drawings and identify the applicable storm water control devices. The Contractor shall inspect and maintain the control structures at these locations.

3.4.5 Rock Berm or Check Dam

Rock Berm or Check Dam is acceptable control structure along stream or steeply sloped or barren swales. The control structure shall have open graded rock of 4 to 8 inches diameter. The graded rock shall be secured with woven sheath of 1-inch diameter opening (maximum) and wire diameter of 20 gauge (minimum). Sediment at 1/3 height of the berm or dam shall be removed.

3.4.6 New and Existing Inlet Protection Device

Sediment Log or gravel filter bags with gravel (size 3 to 5 inch diameter) shall be placed along side with concrete block to prevent sediment from entering new curb and surface inlets at the paved areas, and at existing surface or curb inlet downstream from the disturbed site.

3.4.7 Sand Bag Berm

Sand Bag Berm is acceptable for perimeter control, embankment for sediment basin, sediment barrier for toes of slopes, contributing drainage area greater than 5 acres, slope that is in appropriate for silt fence and straw bale, and as a diversion dike. The Contractor shall inspect sand bag berm after each rain, and the sand bags shall be reshaped or replaced to eliminate sediment in runoff.

3.4.8 Outlet Protection Device

Outlet protection device shall be placed at existing and new drainage outlets to minimize soil scouring by absorbing flow energy to produce non-erosive velocity. See Paragraph, OUTLET PROTECTION OR OUTFALL VELOCITY DISSIPATION DEVICE, this section.

3.4.9 Pipe Slope Drain

Pipe Slope Drain is acceptable for drainage area not to exceed 10 acres.

The Contractor shall inspect outlet pipe for erosion and check the pipe for breakage.

3.4.10 Excavated Sediment Trap

Excavated Sediment Trap is acceptable for drainage area of less than 1 acre and with slope of 5 percent or less, where overflow capacity is needed, and in area of heavy flow of 0.5 CFS or greater. The recommended volume of the sediment trap is 35 cubic yard per acre disturbed. The Contractor shall remove and dispose of sediment when it accumulates to 1/2 of the filter stone (3 to 5 inches diameter of at least 1 foot depth) height.

3.4.10 Diversion or Earth Dike

Diversion Dike shall be placed parallel to existing contours for perimeter control by diverting run-on water away from disturbed area. The dike height shall be at least 1 foot greater than the flow depth for the 10-year storm event. Dike side slopes shall be less than 3 to 1 (0.33 percent grade).

3.4.11 Interceptor Swale

Interceptor Swale shall be placed to divert runoff from disturbed upland area. The flow shall be conveyed to a sediment trapping device. Swale stabilization is required when slope exceeds 2 percent grade.

3.4.12 Geotextile Net

Geotextile net (or fabric) shall be placed along disturbed embankment slope, disturbed area along curbs and gutters, perimeter of disturbed construction site, and disturbed adjacent area of concrete or asphalt pavement. The material shall protect topsoil from wind and water erosion, and promote seed germination. The geotextile net (or fabric) is composed of 100 percent biodegradable material, free of weed seed, and ultra violet light resistant.

3.4.13 Sediment Log

Sediment Log is a sediment control device in lieu of silt fence, straw bale, and rock check dam. It is composed of biodegradable or non-biodegradable material and is weed seed free. The Sediment Log is porous, reusable, holds its shape, and it filters the sediment when storm water pass through the log diameter. It shall be placed in ditch bottoms, swales, waterways, over bare soils turf reinforcement blankets, and around catch basin, storm inlets, drainage outlets, and to retain sediment in the stockpiled area. The standard size Sediment Log is 12-inch diameter or less. For concentrated flow area, a minimum of 20-inch diameter Sediment Log shall be used.

PART 4 STORM WATER MANAGEMENT AND CONTROLS

[AM#2] DELETED

4.1 RUNOFF COMPUTATIONS

The storm drainage design is based on a 10-year storm frequency and 10 -minutes duration with [AM#2] 126.6 mm (4.2 inches) per hour rainfall intensity.

4.2 [AM#2] DELETED

4.3 [AM#2] DELETED

4.4 [AM#2] DELETED

PART 5 BEST MANAGEMENT PRACTICES (BMP)

[AM#2] DELETED

The Contractor (and the subcontractors) shall be responsible for eliminating pollutants in storm runoff from the project site. The Contractor (and subcontractors) shall be responsible for installing and maintaining BMP to minimize storm water pollution. The Contractor operation specific SWPPP shall, as a minimum, identify BMP on Construction Practices (Dewatering Operations, Paving Operations, Structure Construction and Painting); Material Management (Material Delivery and Storage, Material Use, Spill Prevention and Control), Waste Management (Solid Waste Management, Hazardous Waste Management, Contaminated Soil Management, Concrete Waste, Sanitary/Septic Waste Management), Vehicle and Equipment Management (Vehicle and Equipment Cleaning, Vehicle and Equipment Fueling, Vehicle and Equipment Maintenance), Dust Control for Various Site Conditions (Non-Traffic Disturbed Areas, Disturbed Areas Subject to Traffic, Material Stock Pile Stabilization, Clearing/Excavation, Demolition, Truck Traffic on Unpaved Road, Mud/Dirt Carry-Out), and Contractor Training (Employee and Subcontractor Training).

5.1 CONSTRUCTION PRACTICES

Dewatering Operations: The Contractor (and subcontractor) shall prevent discharge of sediment by methods of sediment control, containment, and disposal. In project areas suspected of potential toxic or petroleum products contamination, the water shall be tested to determine method of disposal.

Paving Operations: The Contractor (and subcontractor) shall avoid discharge of pollutants to storm drains by avoiding paving in wet weather or anticipation of such event, storing material in covered containers, covering and berming storage areas, establish control structures, cover on-site storm grates, and worker and subcontractor training.

Structure Construction and Painting: The Contractor (and subcontractor) shall prevent pollutants in storm runoff by covering, or berming material storage areas, keeping job site clean and orderly, using safer alternate products, stabilizing adjacent disturbed areas, storing material in secondary containment, protecting on-site storm drain, establish control structures, and training of workers and subcontractor.

Solid Waste Materials: Trash and uncontaminated construction debris shall be placed in appropriate covered waste containers. Waste containers shall be emptied regularly; they shall not be allowed to overflow. The disposal area of excavated material from project construction shall not be utilized for waste disposal. Routine janitorial service shall be provided for all construction buildings and surrounding grounds. No construction waste materials, including concrete, shall be buried or otherwise disposed of on-site. The Contractor shall brief all on site personnel on good housing keeping and waste minimization.

5.2 MATERIAL MANAGEMENT

Material Delivery and Storage Practice: The Contractor (and subcontractor) shall prevent or reduce discharge of pollutants to storm water by minimizing and on-site storage of hazardous and toxic (HT) materials, storing HT in clearly labeled, corrosion-resistant containers with secondary containment at designated and COR-approved area, conducting frequent inspection, keeping current inventory of construction materials on site, training of workers and subcontractor. The storage of reactive, ignitable or flammable liquids shall comply with applicable fire codes of the project area. The Contractor shall contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements.

Material Use and Inventory: The Contractor (and subcontractor) shall use less hazardous, alternate or environmental friendly material, if possible. The Contractor shall have (1) a list of construction material used on site, (2) the material associated potential pollutants, and (3) method of storage and containment in the Contractor operation specific SWPPP. The Material Safety Data Sheet for each construction material on-site shall be in the Contractor's field and operation activity specific SWPPP and will be available on request by regulator agency visitors, safety officers, or COR.

The following materials are commonly on-site, pesticides and herbicides, fertilizers, detergents, concrete material, petroleum-based products, fertilizers, tar, asphalt, steel reinforcing bars, other hazardous chemicals such as acid, lime, solvents, curing compounds, sealants, paints, glues, fertilizers, steel reinforcing bars, etc.

Spill Prevention and Control: The Contractor (and subcontractor) shall store HT material in covered containers and inside a fenced area, place readily accessible spill clean-up materials, have protocol for stop work immediately, notification, clean-up, labelling, storage and packaging, transportation, disposal, record- keeping, closure activities, and provide training to workers and subcontractor for response to spills.

5.3 WASTE MANAGEMENT

Solid Waste: Solid waste materials (i.e. excess fresh concrete, grout, mortar or uncontaminated debris) shall be placed in covered containers, and recycled, if possible. Trees and shrubs from site clearing shall be used as mulching material, if possible. Packaging materials such as wood, plastic, and paper shall be recycled to the maximum extent possible and not be disposed of in a landfill. The Contractor shall designate waste containers for segregating waste (domestic, metal, aluminum or plastic). Dry paint cans shall be recycled. The Contractor shall designate waste disposal area, have routine janitorial service for all structures and surrounding grounds, and have routine schedule to service waste containers.

The disposal area of excavated material from project construction shall not be utilized for waste disposal. Personnels on the job site shall be briefed on minimizing disposal to landfill by waste segregation and recycling.

Hazardous and Toxic Waste: All excess on-site material such as paints, solvents, petroleum products (fuel, oil, and grease), herbicides, pesticides, acids for cleaning masonry, concrete curing compounds, sealants, paint strippers, wastes from oil-based paint, and glues could become HT waste. Containers of excess material shall be labeled and managed according to the labels and as recommended by the product manufacturers. If no instruction is provided, the Contractor shall turn in contained waste to the installation DRMO, the local household hazardous

waste drop-off, or recycling program.

[AM#2] DELETED

[AM#2] DELETED

Contaminated Soil: If suspicious of soil contamination during soil moving activities, the Contractor (and subcontractor) shall stop work, notify COR, and establish containment to prevent soil transport or runoff from that location. For removal of contaminated soil, a WORK PLAN shall be prepared for COR approval prior to handling and management of the material. The WORK PLAN shall at least include the following: containment, sampling & analyses, notification to regulatory agencies, transportation, worker safety, training & environmental monitoring, disposal, and documentation and record-keeping.

Construction and Concrete Waste: Construction waste or surplus materials, demolition building debris, scrap metal, rubber, plastic, glass, concrete, and masonry products shall be segregated and recycled to minimize landfill disposal. No construction waste shall be buried or disposed of on-site. Concrete waste shall be controlled and minimized by appropriate storage methods for dry and wet materials, and controlling amount of concrete and cement mixed on site. Sweepings from exposed aggregate concrete shall be collected and returned to aggregate stockpile and they shall not be washed into streets or storm drains. Washout of concrete truck shall be at a designated location that is (1) at least 50 feet from storm drains, open ditches, or water bodies, and (2) surrounded by a containment berm with a temporary pit or sediment trap for containment and settling of washout. Settled solids and set concrete from the pit or trap shall be removed and disposed of properly. Sediment shall be removed and disposed of in accordance with local regulations, and water from the pit or trap shall be pumped to a sanitary sewer with written approval from the COR.

Sanitary/Septic Waste: On-site sanitary facilities shall be established at a convenient location. Facility location, design, maintenance, and waste collection practices shall be approved by COR and are in accordance with local regulations. The Contractor (and subcontractor) shall have a routine schedule for waste pump out by a licensed hauler. Septic waste treatment system shall have a pre-construction permit from the local health regulating agency and have contract service with a licensed company. Temporary sanitary facilities discharging to sanitary sewer system shall be approved by the operator of the system and properly connected to avoid illicit discharges. Wastewater from water-based paint shall not be discharged as sanitary waste.

Building Exterior Cleaning or High-pressure Wash: Storm drains shall be protected by approved storm water control device. Wash onto dirt area, spade in, settle solids in pit, collect (mop up) and discharge to sanitary sewer (with approval from sewer operator). If the exterior paint contains lead exceeding the levels stated in the Consumer Safety Standard, mercury or mildewcide, the wash water shall be collected and disposed of as HT waste.

Street/Pavement Cleaning: Water used for this activity shall be minimized and sediment basin shall be used to contain wastewater. At completion of construction, the silt shall be removed and disposed of in accordance with applicable regulations, and water from the basin shall be pumped to a sanitary sewer with written approval from the COR.

5.4 VEHICLE AND EQUIPMENT MANAGEMENT

Off-site Vehicle Tracking and Dust Control: The Contractor is required to keep vehicles from tracking soils from the project, borrow, and disposal sites. Temporary parking area(s) to be used 30 calendar days or more for the Contractor's equipment or personal vehicles shall be [AM#2] _____ a stabilized gravel area with storm water control device. The temporary parking areas shall be removed by the Contractor upon project completion and restored to the satisfaction of the COR. Sprinkling, chemical treatment, light bituminous treatment, or similar methods shall be used for dust control; see Sections 01355 ENVIRONMENTAL PROTECTION and 01561 DUST CONTROL [AM#2] _____. Materials to be transported by truck or other equipment that promote fugitive particle emissions shall be covered and/or sprayed. Use of sprinkling shall be controlled to prevent runoff.

Vehicle and Equipment Cleaning: Washing shall be performed off site at a commercial washing facility that has an oil/water separator as pre-treatment prior to sanitary sewer connection. If washing must occur on site, the wash area shall have written approval from the COR. The on-site wash area shall be bermed from contact with storm drainage system, and detergent shall be bio-degradable. Wastewater shall drain into a lined sediment basin constructed by the Contractor. After project completion, the Contractor shall clean the basin, test and dispose of sediment, in accordance with applicable regulations and to the satisfaction of the COR. Steam cleaning is prohibited on site because it generates significant pollutant concentrations.

Vehicle and Equipment Fueling: Fueling shall be off-site. If fueling must occur on-site, a written approval shall be obtained from COR. If fueling is allowed by the COR, it shall be at a designated area, at least 50 feet away from drainage courses. Fueling operations shall avoid topping of fuel tank, avoid mobile fueling of mobile construction equipment. Fueling locations shall use secondary containment such as drip pan or drop cloth to catch spill or leak, have a stockpile of cleanup material, and absorbent material for immediate clean-up of small spills. A permit shall be obtained from state or local regulatory agency for all on-site fuel storage tanks. In case of spill, avoid hosing down or burial of spilled fuel. The fuel containers shall meet the industrial standard, labeled and stored in accordance with applicable Federal, state, and local codes.

Vehicle and Equipment Maintenance: Outdoor vehicle or equipment maintenance is a significant potential source of storm water pollution. Activities include engine repair, changing fluids, etc. shall be prohibited on job site.

Vehicle and Equipment Parking: All vehicle or equipment parked on-site shall have drip pan or drip cloth to catch spill or leak. Vehicle or equipment (the Contractor and the subcontractor) shall regularly inspect for leaks and schedule routine maintenance to reduce the potential for leaks.

5.5 EMPLOYEE AND SUBCONTRACTOR TRAINING

The Contractor is responsible to provide training for all workers (including the subcontractor) on the job site. The objectives in training are to provide a clear concept of activities or problems that generate pollutants to storm water, identify solutions (BMPs), promote ownership of the problems and solutions, and integrate feedback into training and BMP

implementation. A certificate shall be signed by all trained personnel.

5.6 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

The complete edited section is the Basic SWPPP and the Contractor shall revise it to a field and operation specific SWPPP. The SWPPP shall be retained at the job site at all times and readily available to inspector in case of site inspection conducted by the regulating agency. The Construction Site Notice shall indicate the location of SWPPP. The SWPPP shall be completed before filing for NOI. It shall be implemented prior to start of soil disturbing activities. It shall be updated, as necessary, to reflect changing site conditions, BMP practices, new operations or areas of responsibility. The SWPPP REVISION RECORD shall be an attachment to the SWPPP.

5.7 SPILL CONTROL AND REPORTING

In case of spill of hazardous, toxic, and radiological waste (HTRW), the Contractor shall stop work, contain spill, notify the COR and Safety Office, and execute spill control per the SPILL CONTROL PLAN as required in specification SECTION 01355 ENVIRONMENTAL PROTECTION. Spill containment, notification, clean-up, restoration, reporting, record-keeping, etc. shall be in accordance with 40 CFR 110, other applicable Federal, state, and local regulations, and to the satisfaction of the COR.

PART 6 TIMING OF CONTROLS AND ACTIVITIES.

[AM#2] DELETED

The Contractor shall (1) sequence soil disturbing activities to preserve existing vegetation, (2) minimize area of disturbance, (3) establish storm water control devices, (4) do not disturb an area until it is necessary to proceed with field work, (5) stabilize disturbed areas as soon as practicable, (6) delay construction of infiltration measures until the end of project when upstream drainage areas are stabilized and established, (7) maintain storm water control devices until stabilized disturbed areas have achieved final stabilization. Final stabilization depicts soil disturbing activities at the site have been completed and a uniform (e.g. evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of all native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as use of rip rap, gabions, or geotextiles) have been employed.

The Contractor's field and operation specific SWPPP shall (1) sequence major construction activities, (2) discuss erosion and sediment control measures, and (3) sequence temporary or permanent stabilization.

- Install silt fences [AM#2] _____ around perimeter & down slope of construction site.
- Construct stabilized construction entrances.
- Install controls around contractor staging, stockpiled storage, parking, borrow, and disposal area [AM#2] s for on-site and off-site locations.
- Clearing and Grubbing]
- Install inlet protections at all existing storm grates (i.e. curb inlets surface inlets, manholes, etc.)
- Install controls (i.e. rock berm/check/check dam, sediment log,

diversion/earth dike) at outfall locations and natural drainage ways down stream from the construction site.

- Regulated Material Abatement from structures to be demolished
- Demolition of structures
- Grading
- Implement Temporary Stabilization on graded areas that have no scheduled field work beyond 14 days
- Construct storm water treatment unit or interceptor
- Construct permanent storm water management structures
- Trenching and excavation for utilities, trenching and excavation
- Cover all excavated or other soil stockpiles with soil retention blankets at the end of each work day and at the threat of precipitation.
- Install inlet protections at all new storm grates (i.e. curb inlets surface inlets, manholes, etc.)
- Backfill the utility trenches in a timely manner to minimize erosion.
- [AM#2]- Monitor weather using National Weather Services reports to track conditions and alert crews to forecast rainfall or dust storm event and avoid paving, concrete saw cutting, dust or pollutant generating activities.
- [AM#2]- Stabilize disturbed soil before rainfall events.
- [AM#2]- Paving and other flatwork.
- [AM#2] _____
- Implement permanent stabilization.
- Routinely inspect and maintain erosion and sediment structural control structures; evaluate BMP & revise SWPPP for change conditions or field activities; assess and certify non-storm water discharges; maintain field records and training logs [AM#2] _____.
- [AM#2] Maintain (i.e. water, fertilize, [AM#2] _____ mow, reseed (if necessary) the temporary and permanent stabilized area [AM#2] until final project acceptance [AM#2] _____.
- Remove all controls when the project area has achieved final stabilized and all construction is completed and accepted by the Contracting Officer, after site work completion and prior to project acceptance perform I & M of storm control conducted monthly.]

PART 7 COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS

[AM#2] DELETED

[AM#2] _____ In compliance with Clean Water Act, Section 402, the Contractor and the subcontractor shall conform with all applicable NPDES, and TPDES [AM#2] _____ General Permit. In addition, the Contractor (including the subcontractor shall comply with applicable requirements and implement the Storm Water Pollution Prevention Plan and BMP measures prior to commencing soil disturbing activities.

PART 8 MAINTENANCE AND INSPECTION PROCEDURES

The Contractor shall designate a Storm Water Inspector on-site to perform SWPPP quality control. All BMP and control structures shall be inspected at least once every seven (7) days and within twenty-four (24) hours following any storm producing 0.5 inch or more of rainfall. The Contractor Designated SWPPP Inspector shall have a basic knowledge of the engineering principles in reducing pollutants in storm water, past experience and thoroughly understand the requirements of the Storm Water Discharge Construction Permit, BMP, Government contractual, and SWPPP requirements, worker training, storm control device inspection and maintenance, SWPPP revision, documentation and record-keeping.

Inspection of erosion and soil loss from the outfall and perimeter of the site. Temporary erosion control measures shall be inspected for bare spots and washouts. Discharge points shall be inspected for signs of erosion or sediment. Locations where vehicles enter and leave the site shall be checked for signs of off-site sediment tracking, including erosion control structure at contractor staging, material borrow, disposal, and stockpiled areas. The Contractor shall continually review the Best Management Practices (BMP) and effectiveness of SWPPP program. All deficiencies shall be corrected and recorded in [AM#2] ____ [AM#2] SECTION 01421R - SWPPP INSPECTION AND MAINTENANCE REPORT and a current copy shall be provided to the COR. Corrections to these problems shall be implemented within seven (7) calendar days. After final stabilization has been achieved, the Contractor shall inspect the site once a month until final inspection and project acceptance by the COR.

PART 9 LIST OF ON-SITE MATERIALS AND OTHER POLLUTANT SOURCES

[AM#2] All materials or substances brought on-site during construction shall have a Material Safety Data Sheet (MSDS) available to the Contracting Officer. [AM#2] ____.

[AM#2] DELETED

PART 10 PROHIBITION ON NON-STORM WATER DISCHARGES

In accordance with the Federal Register, Volume 63, No.128, July 6, 1998 Notices, non-storm water discharge is prohibited during construction of the project, except for a list of non-storm water discharges. The following list of non-storm water discharges from active construction site is allowed and is developed based on the above guideline.

- fire fighting activities,
- fire hydrants flushings,
- vehicle wash waters which do not contain detergent or leaked fluids
- dust control runoff to minimize off-site tracking of vehicles,
- potable water sources including waterline flushings,
- routine external building wash down which does not use detergents and the exterior paint that does not contain mercury, lead, cadmium, and mildewcides,
- pavement wash waters where spills or leaks do not contain hazardous, toxic, radiological material or detergent,
- air conditioning condensate,
- uncontaminated spring or ground water,
- foundation and footing drains which do not contain contaminated process materials such as solvents

The Contractor designated SWPPP Inspector shall perform routine inspection and record findings in the NON-STORM WATER DISCHARGE ASSESSMENT AND CERTIFICATION.

PART 11 CONTRACTOR COMPLIANCE

[AM#2] DELETED

11.1 SWPPP AND NOTICE OF INTENT (NOI)

[AM#2] DELETED

The Contractor shall use this section to prepare a field and operation

activity specific SWPPP that includes both narrative and drawings (preferable size 11" by 17") and also in electronic format compatible with the contract requirements. The Contractor SWPPP (both narrative and revised drawings) shall be submitted for review and approval. The Contractor's SWPPP shall, as a minimum, include the following: (1) each area of construction, describe each physical location & LATITUDE and LOGITUDE of each area; (2) the project start and completion dates; (3) sequence of construction activities and pollution control measures; (4) Best Management Practices (BMP); 5) list of on-site construction materials, methods of storage, & pollution control measures; (6) each construction area runoff coefficient; (7) revise SWPPP drawings depict storm control devices (i.e. perimeter, down grade, inlet & outfall controls, site stabilized entrance/exit, Contractor staging & parking, stockpiled, borrow, and disposal areas), limit of clearing and grubbing, haul route, surface water flow direction arrows, site direction arrow, and legend; (9) name and qualification of a Designated SWPPP Inspector to inspect, maintain/repair erosion control structures, record findings and subsequent actions, evaluate BMP and revise SWPPP, assess non-storm or monitor concrete/asphalt plant discharges; (10) record start/stop dates for temporary/permanent ceasing of major construction activities (clearing & grubbing; grading, trenching & excavation; dirt moving, etc.); start dates of temporary and permanent stabilization; repair dates for control structures; release dates of reportable quantities (RQ) for oil and hazardous substances per 40 CFR Parts 110, 117 and 302; repair date of control device; (11) Contractor on-site training to workers; (12) SWPPP revision date for changed site conditions, operation, and BMP; (13) prepare [AM#2] and submit Contractor's NOI, and pay for NOI fee. The Contractor shall [AM#2] submit [AM#2] NOI and wait [AM#2] at least 2 days prior to commencing work [AM#2] in the State of Texas and Louisiana. The waiting period for the State of New Mexico is at least 7 days after submittal of NOI.: (14) prepare [AM#2] Government's [AM#2] NOI and obtain authorized signature from Government. [AM#2]. The mailing addresses for NOI submittal are:

[AM#2] DELETED
TEXAS

Mailing Address:

Texas Commission On Environmental Quality (TCEQ)
Storm Water & General Permits Team; MC-228
P.O. Box 13087
Austin, TX 78711-3087
(Use for regular and certified mail)

NOI Payment Address (by regular U.S. Mail):

Texas Commission on Environmental Quality (TCEQ)
Financial Administration Division
Cashier's Office, MC-214
P.O. Box 13088
Austin, TX 78711-3088

NOI Payment Physical Address:

Texas Commission on Environmental Quality (TCEQ)
Financial Administration Division
Cashier's Office, MC-214
12100 Park 35 Circle
Austin, TX 78753
(Use for overnight express carrier deliveries (U.S. Post Office Express Mail, fed ex, UPS, etc.))

[AM#2] DELETED

[AM#2] DELETED

The Contractor shall provide SWPPP (including the revised Storm Water Control Plans) and all necessary attachment [AM#2] (see PART 12) for approval.

[AM#2] _____

11.1.1 On-Site Construction Document And Record-Keeping

A copy of each of the following shall be maintained at the project site at all times: [AM#2] USACE approved [AM#2] _____ SWPPP and all attachments, TPDES [AM#2] TXR 150000 [AM#2] _____ General Permit, [AM#2] and the Project Site Notice [AM#2] _____ .

The Contractor shall post a Site Notice near the main entrance of each construction access point. The Site Notice shall have the following information: a copy of NOI that has an authorization number issued by TCEQ (for each co-permittee, the Government and the Contractor), a brief project description, name and telephone number of an operator's representative (for each Contractor & the Government), and the location of SWPPP.

All records pertaining to TPDES [AM#2] _____ permit shall be maintained for a minimum of three (3) years from the date that a NOT is submitted.

11.1.2 TPDES [AM#2] _____ General Permit Fees And Fines For Non-Compliance

The Contractor is responsible for all fees pertaining to the storm water construction permit for both the Contractor and the Government (including applicable annual water quality or monitoring fees [AM#2] _____). Any fines levied by regulatory agencies regarding non-compliance with TPDES [AM#2] _____ regulations or the requirements of this Section shall be paid by the Contractor.

11.2 NOTICE OF TERMINATION (NOT)

No later than 30 working days after completion of final stabilization and approval by the COR, the Contractor shall prepare copies of the Notice of Termination (NOT) separately, for the Contractor and the Government. The Contractor shall provide the filled out Government NOT to the COR for a signature from an authorized person, and then submit it to Texas Commission on Environmental Quality (TCEQ)[AM#2] _____. A copy of the Government NOT and the Contractor NOT shall be provided to the COR.

11.3 NOTIFICATION TO MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)

A copy of each NOI & NOT (for large construction site), a copy of NOC (Notice of Change is required when relevant information of the initial NOI needs changes), a copy of Construction Site Notice (applicable for small construction site) shall be sent to MS4. For some projects, there is a possibility of more than one MS4. The Contractor shall notify all MS4 within the project site.

[AM#2] _____.

[AM#2] _____.

[AM#2] _____.

III Corps & Fort Hood
Attn: AFZF-PW-ENV (Riki Young)
Fort Hood TX 76544-5028
Telephone: 254-387-8712

[AM#2] _____.

[AM#2] _____

PART 12 ATTACHMENTS

The Contractor shall provide the following attachments in the Contractor [AM#2] _____ operation [AM#2] _____ specific SWPPP. The list of attachments shall include CONSTRUCTION SITE NOTICE, CONTRACTOR NOTICE OF INTENT (NOI), GOVERNMENT NOTICE OF INTENT (NOI), CONTRACTOR NOTICE OF TERMINATION (NOT), GOVERNMENT NOTICE OF TERMINATION (NOT), CONTRACTOR STORM WATER CONTROL INSPECTION AND MAINTENANCE REPORT, TRAINED CONTRACTOR PERSONNEL LOG, OPERATOR (CONTRACTOR/ SUBCONTRACTOR) CERTIFICATION OF COMPLIANCE FOR [AM#2] _____ TPDES, RECORD OF SWPPP REVISION, RECORD OF MAJOR CONSTRUCTION ACTIVITIES (Grading, Temporary/ Permanent Ceasing/Resuming Construction, stabilization) CONTRACTOR DESIGNATED SITE SWPPP INSPECTOR, CONTRACTOR CERTIFICATION FOR SWPPP, SCHEUDLE OF SITE RESPONSIBLE PARTIES FOR POLLUTION PREVENTION MEASURES [AM#2] (identify the Contractor Storm Water Pollution Prevention site inspector name and qualifications, other responsible parties such as the subcontractors), NON-STORM WATER DISCHARGE ASSESSMENT AND CERTIFICATION, AUTHORIZED SIGNATORY, NOTE: if applicable, CONCRETE BATCH FACILITIES - DISCHARGE MONITORING REPORT.

The Basic SWPPP shall include attachment of [AM#2] _____ TPDES [AM#2] _____ General Permit, the Government NOI and [AM#2] _____ NOT.

-- End of Section --

SECTION 01421R

SWPPP INSPECTION AND MAINTENANCE REPORT
05/2003
AMENDMENT #0002

PART 1 GENERAL

1.1 SWPPP INSPECTION AND MAINTENANCE REPORT

STORMWATER POLLUTION PREVENTION PLAN

INSPECTOR: _____ DATE: _____

INSPECTOR'S
QUALIFICATION: _____

DAYS SINCE LAST RAINFALL: _____ AMOUNT OF LAST RAINFALL: _____ INCHES

STABILIZATION MEASURES

AREA	DATE SINCE LAST DISTURBANCE	DATE OF NEXT DISTURBANCE	STABILIZED? (YES/NO?)	STABILIZED WITH	CONDITION
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STORMWATER POLLUTION PREVENTION PLAN

STABILIZATION REQUIRED:

TO BE PERFORMED BY: _____ ON or BEFORE: _____

STORMWATER POLLUTION PREVENTION PLAN

OTHER CONTROLS - STABILIZED CONSTRUCTION ENTRANCE

IS MUCH SEDIMENT TRACKED ONTO THE ROAD?	ARE DUST AND SEDIMENT CONTROL MEASURES WORKING?	DOES ALL TRAFFIC USE THE STABILIZED ENTRANCE TO THE SITE?	ARE ASSOCIATED DRAINAGE STRUCTURES WORKING?
-----------------------------------------------	----------------------------------------------------------	--------------------------------------------------------------------	------------------------------------------------------

MAINTENANCE REQUIRED FOR CONSTRUCTION ENTRANCE:

TO PERFORMED BY: _____ ON OR BEFORE: _____

OTHER CONTROLS - DEVELOP SITE SPECIFIC TABLES AS NEEDED

FOR ALL STABILIZATION MEASURES, STRUCTURAL, AND NON-STRUCTURAL CONTROLS
CHANGES/CORRECTIONS REQUIRED IN POLLUTION PREVENTION PLAN:

REASONS FOR CHANGES:

INSPECTOR'S SIGNATURE: _____ DATE: _____

STORMWATER POLLUTION PREVENTION PLAN

MAINTENANCE REQUIRED FOR SEDIMENT BASIN(S):

TO BE PERFORMED BY: _____ ON OR BEFORE: _____

STRUCTURAL CONTROLS - SILT FENCE(S)

FROM	TO	IS THE BOTTOM OF THE FABRIC STILL BURIED?	IS THE FABRIC IN GOOD CONDITION?	HOW DEEP IS THE SEDIMENT?
<hr/>				

MAINTENANCE REQUIRED FOR THE SILT FENCE (S):

TO BE PERFORMED BY: _____ ON OR BEFORE: _____

STORMWATER POLLUTION PREVENTION PLAN

STRUCTURAL CONTROLS - EARTH DIKES(S)

FROM	TO	IS DIKED STABILIZED?	IS THERE EVIDENCE OF WASH-OUT OR OVERTOPPING?
------	----	----------------------	--------------------------------------------------

MAINTENANCE REQUIRED FOR THE EARTH DIKE(S):

TO BE PERFORMED BY: _____ ON OR BEFORE: _____

-- End of Section --



TPDES General Permit
NO. TXR150000

This is a new general permit
issued pursuant to Section
26.040 of the Texas Water Code
and Section 402 of the Clean
Water Act.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
P.O. BOX 13087
Austin, TX 78711-3087

GENERAL PERMIT TO DISCHARGE WASTE

under provisions of
Section 402 of the Clean Water Act
and Chapter 26 of the Texas Water Code

Construction sites located in the state of Texas

may discharge to surface water in the state

only according to effluent limitations, monitoring requirements and other conditions set forth in this permit, as well as the rules of the Texas Commission on Environmental Quality (TCEQ), the laws of the State of Texas, and other orders of the TCEQ. The issuance of this general permit does not grant to the permittee the right to use private or public property for conveyance of storm water and certain non-storm water discharges along the discharge route. This includes property belonging to but not limited to any individual, partnership, corporation or other entity. Neither does this permit authorize any invasion of personal rights nor any violation of federal, state, or local laws or regulations. It is the responsibility of the permittee to acquire property rights as may be necessary to use the discharge route.

This permit and the authorization contained herein shall expire at midnight five years after the date of issuance.

ISSUED AND EFFECTIVE DATE:

For the Commission

**TCEQ General Permit Number TXR150000 Relating To Discharges
From Construction Activities**

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Part I. Definitions

Best Management Practices - (BMPs) Schedules of activities, prohibitions of practices, maintenance procedures, structural controls, local ordinances, and other management practices to prevent or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control construction site runoff, spills or leaks, waste disposal, or drainage from raw material storage areas.

Commencement of Construction - The exposure of soils resulting from activities such as clearing, grading, and excavating.

Common Plan of Development - A construction activity that is completed in separate stages, separate phases, or in combination with other construction activities. A common plan of development is identified by the documentation for the construction project that identifies the scope of the project, and may include plats, blueprints, marketing plans, contracts, building permits, a public notice or hearing, zoning requests, or other similar documentation and activities.

Facility or Activity - Any TPDES “point source” or any other facility or activity (including land or appurtenances thereto) that is subject to regulation under the TPDES program.

Final Stabilization - A construction site status where either of the following conditions are met:

- (a) All soil disturbing activities at the site have been completed and a uniform (e.g, evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.
- (b) For individual lots in a residential construction site by either:
 - (1) the homebuilder completing final stabilization as specified in condition (a) above; or
 - (2) the homebuilder establishing temporary stabilization for an individual lot prior to the time of transfer of the ownership of the home to the buyer and after informing the homeowner of the need for, and benefits of, final stabilization.
- (c) For construction activities on land used for agricultural purposes (e.g. pipelines across crop or range land), final stabilization may be accomplished by returning the disturbed land to its preconstruction agricultural use. Areas disturbed that were not previously used for agricultural activities, such as buffer strips immediately adjacent to a surface water and areas which are not being returned to their preconstruction agricultural use must meet the final stabilization conditions of condition (a) above.

Large Construction Activity - Construction activities including clearing, grading, and excavating that result in land disturbance of equal to or greater than five (5) acres of land. Large construction activity also includes the disturbance of less than five (5) acres of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb equal to or greater than five (5) acres of land. Large construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, and original purpose of a ditch, channel, or other similar storm water conveyance. Large construction activity does not include the routine grading of existing dirt roads, asphalt overlays of existing roads, the routine clearing of existing right-of-ways, and similar maintenance activities.

Municipal Separate Storm Sewer System (MS4) - A separate storm sewer system owned or operated by a state, city, town, county, district, association, or other public body (created by or pursuant to state law) having jurisdiction over the disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under state law such as a sewer district, flood control or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization.

Notice of Intent (NOI) - A written submission to the executive director from an applicant requesting coverage under a general permit.

Notice of Termination (NOT) - A written submission to the executive director from a permittee authorized under a general permit requesting termination of coverage.

Operator - The person or persons associated with a large or small construction activity that meets either of the following two criteria:

- (a) the person or persons have operational control over construction plans and specifications to the extent necessary to meet the requirements and conditions of this general permit; or
- (b) the person or persons have day-to-day operational control of those activities at a construction site which are necessary to ensure compliance with a storm water pollution prevention plan for the site or other permit conditions (e.g. they are authorized to direct workers at a site to carry out activities required by the Storm Water Pollution Prevention Plan or comply with other permit conditions).

Permittee - An operator authorized under this general permit. The authorization may be gained through submission of a notice of intent, by waiver, or by meeting the requirements for automatic coverage to discharge storm water runoff and certain non-storm water discharges.

Point Source - Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are, or may be, discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.

Pollutant - (from the Texas Water Code, Chapter 26) Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, filter backwash, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into any surface water in the state. The term "pollutant" does not include tail water or runoff water from irrigation or rainwater runoff from cultivated or uncultivated rangeland, pastureland, and farmland.

Pollution - (from the Texas Water Code, Chapter 26) The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any surface water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

Runoff Coefficient - The fraction of total rainfall that will appear at the conveyance as runoff.

Separate Storm Sewer System - A conveyance or system of conveyances (including roads with drainage systems, streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains), designed or used for collecting or conveying storm water; that is not a combined sewer, and that is not part of a publicly owned treatment works (POTW).

Small Construction Activity - Construction activities including clearing, grading, and excavating that result in land disturbance of equal to or greater than one (1) acre and less than five (5) acres of land. Small construction activity also includes the disturbance of less than one (1) acre of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb equal to or greater than one (1) and less than five (5) acres of land. Small construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, and original purpose of a ditch, channel, or other similar storm water conveyance. Small construction activity does not include the routine grading of existing dirt roads, asphalt overlays of existing roads, the routine clearing of existing right-of-ways, and similar maintenance activities.

Storm Water - Storm water runoff, snow melt runoff, and surface runoff and drainage.

Storm Water Associated with Construction Activity - Storm water runoff from a construction activity where soil disturbing activities (including clearing, grading, excavating) result in the disturbance of one (1) or more acres of total land area, or are part of a larger common plan of development or sale that will result in disturbance of one (1) or more acres of total land area.

Structural Control (or Practice) - A pollution prevention practice that requires the construction of a device, or the use of a device, to capture or prevent pollution in storm water runoff. Structural controls and practices may include but are not limited to: silt fences, earthen dikes, drainage swales, sediment traps, check dams, subsurface drains, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins.

Surface Water in the State - Lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, wetlands, marshes, inlets, canals, the Gulf of Mexico inside the territorial limits

of the state (from the mean high water mark (MHW) out 10.36 miles into the Gulf), and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, navigable or nonnavigable, and including the beds and banks of all water-courses and bodies of surface water, that are wholly or partially inside or bordering the state or subject to the jurisdiction of the state; except that waters in treatment systems which are authorized by state or federal law, regulation, or permit, and which are created for the purpose of waste treatment are not considered to be water in the state.

Temporary Stabilization - A condition where exposed soils or disturbed areas are provided a protective cover, which may include temporary seeding, geotextiles, mulches, and other techniques to reduce or eliminate erosion until either final stabilization can be achieved or until further construction activities take place.

Waters of the United States - (from title 40, part 122, section 2 of the Code of Federal Regulations) Waters of the United States or waters of the U.S. means:

- (a) all waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
- (b) all interstate waters, including interstate wetlands;
- (c) all other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds that the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:
 - (1) which are or could be used by interstate or foreign travelers for recreational or other purposes;
 - (2) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
 - (3) which are used or could be used for industrial purposes by industries in interstate commerce;
- (d) all impoundments of waters otherwise defined as waters of the United States under this definition;
- (e) tributaries of waters identified in paragraphs (a) through (d) of this definition;
- (f) the territorial sea; and
- (g) wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR § 423.11(m) which also meet the criteria of this definition) are not waters of the United States. This exclusion applies only to manmade bodies of water which neither were originally created in waters of the United States (such as disposal area in wetlands) nor resulted from the impoundment of waters of the United States. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

Part II. Permit Applicability and Coverage

Section A. Discharges Eligible for Authorization

1. Storm Water Associated with Construction Activity

Discharges of storm water runoff from small and large construction activities may be authorized under this general permit.

2. Discharges of Storm Water Associated with Construction Support Activities

Discharges of storm water runoff from construction support activities, including concrete batch plants, asphalt batch plants, equipment staging areas, material storage yards, material borrow areas, and excavated material disposal areas may be authorized under this general permit provided:

- (a) the activity is located within a 1-mile distance from the boundary of the permitted construction site and directly supports the construction activity;
- (b) the storm water pollution prevention plan is developed according to the provisions of this general permit and includes appropriate controls and measures to reduce erosion and discharge of pollutants in storm water runoff from the supporting industrial activity site; and
- (c) the industrial activity either does not operate beyond the completion date of the construction activity or obtains separate TPDES authorization for discharges.

3. Non-storm Water Discharges

The following non-storm water discharges from sites authorized under this general permit are also eligible for authorization under this general permit:

- (a) discharges from fire fighting activities;

- (b) fire hydrant flushings;
- (c) vehicle, external building, and pavement wash water where detergents and soaps are not used and where spills or leaks of toxic or hazardous materials have not occurred (unless spilled materials have been removed; and if local state, or federal regulations are applicable, the materials are removed according to those regulations), and where the purpose is to remove mud, dirt, an dust;
- (d) water used to control dust;
- (e) potable water sources including waterline flushings;
- (f) air conditioning condensate;
- (g) uncontaminated ground water or spring water, including foundation or footing drains where flows are not contaminated with industrial materials such as solvents.

4. Other Permitted Discharges

Any discharge authorized under a separate NPDES, TPDES, or TCEQ permit may be combined with discharges authorized by this permit.

Section B. Limitations on Permit Coverage

1. Post Construction Discharges.

Discharges that occur after construction activities have been completed, and after the construction site and any supporting activity site have undergone final stabilization, are not eligible for coverage under this general permit. Discharges originating from the sites are not authorized under this general permit following the submission of the notice of termination (NOT) for the construction activity.

2. Prohibition of Non-Storm Water Discharges

Except as provided in Part II. A.2., A3., and A4., all discharges authorized by this general permit must be composed entirely of storm water associated with construction activity.

3. Compliance With Water Quality Standards

Discharges to surface water in the state that would cause or contribute to a violation of water quality standards or that would fail to protect and maintain existing designated uses are not eligible for coverage under this general permit. The executive director may require an application for an individual permit or alternative

general permit (see Part II.G.3) to authorize discharges to surface water in the state from any activity that is determined to cause a violation of water quality standards or is found to cause, or contribute to, the loss of a designated use. The executive director may also require an application for an individual permit considering factors described in Part II. G.2.

4. Discharges to Water Quality-Impaired Receiving Waters.

New sources or new discharges of the constituents of concern to impaired waters are not authorized by this permit unless otherwise allowable under 30 TAC Chapter 305 and applicable state law. Impaired waters are those that do not meet applicable water quality standards and are listed on the EPA approved Clean Water Act Section 303(d) list. Constituents of concern are those for which the water body is listed as impaired.

Discharges of the constituents of concern to impaired water bodies for which there is a total maximum daily load (TMDL) implementation plan are not eligible for this permit unless they are consistent with the approved TMDL and the implementation plan. Permittees must incorporate the limitations, conditions, and requirements applicable to their discharges, including monitoring frequency and reporting required by TCEQ rules, into their storm water pollution prevention plan in order to be eligible for coverage under this general permit.

5. Discharges to the Edwards Aquifer Recharge Zone

Discharges cannot be authorized by this general permit where prohibited by 30 Texas Administrative Code (TAC) Chapter 213 (relating to Edwards Aquifer).

- (a) For new discharges located within the Edwards Aquifer Recharge Zone, or within that area upstream from the recharge zone and defined as the Contributing Zone, operators must meet all applicable requirements of, and operate according to, 30 TAC Chapter 213 (Edwards Aquifer Rule) in addition to the provisions and requirements of this general permit.
- (b) For existing discharges, the requirements of the agency-approved Water Pollution Abatement Plan under the Edwards Aquifer Rules are in addition to the requirements of this general permit. BMPs and maintenance schedules for structural storm water controls, for example, may be required as a provision of the rule. All applicable requirements of the Edwards Aquifer Rule for reductions of suspended solids in storm water runoff are in addition to the requirements in this general permit for this pollutant. For discharges from large construction activities located on the Edwards Aquifer contributing zone, applicants must also submit a copy of the NOI to the appropriate TCEQ regional office.”

Counties:

Contact:

Comal, Bexar, Medina, Uvalde,
and Kinney

TCEQ
Water Program Manager
San Antonio Regional Office
14250 Judson Rd.
San Antonio, Texas
(210) 490-3096

Williamson, Travis, and Hays

TCEQ
Water Program Manager
Austin Regional Office
1921 Cedar Bend Dr., Ste. 150
Austin, Texas
(512) 339-2929.

6. Discharges to Specific Watersheds and Water Quality Areas

Discharges otherwise eligible for coverage cannot be authorized by this general permit where prohibited by 30 TAC Chapter 311 (relating to Watershed Protection) for water quality areas and watersheds.

7. Protection of Streams and Watersheds by Other Governmental Entities

This general permit does not limit the authority or ability of federal, other state, or local governmental entities from placing additional or more stringent requirements on construction activities or discharges from construction activities. For example, this permit does not limit the authority of a home-rule municipality provided by Section 401.002 of the Texas Local Government Code.

8. Indian Country Lands

Storm water runoff from construction activities occurring on Indian Country lands are not under the authority of the TCEQ and are not eligible for coverage under this general permit. If discharges of storm water require authorization under federal National Pollutant Discharge Elimination System (NPDES) regulations, authority for these discharges must be obtained from the U.S. Environmental Protection Agency (EPA).

9. Oil and Gas Production

Storm water runoff from construction activities associated with the exploration, development, or production of oil or gas or geothermal resources, including transportation of crude oil or natural gas by pipeline, are not under the authority of the TCEQ and are not eligible for coverage under this general permit. If discharges

of storm water require authorization under federal NPDES regulations, authority for these discharges must be obtained from the EPA.

10. Storm Water Discharges from Agricultural Activities

Storm water discharges from agricultural activities that are not point source discharges of storm water are not subject to TPDES permit requirements. These activities may include clearing and cultivating ground for crops, construction of fences to contain livestock, construction of stock ponds, and other similar agricultural activities.

Section C. Deadlines for Obtaining Authorization to Discharge

1. Large Construction Activities

- (a) New Construction - Discharges from sites where the commencement of construction occurs on or after the issuance date of this general permit must be authorized, either under this general permit or a separate TPDES permit, prior to the commencement of those construction activities.
- (b) Ongoing Construction - Operators of large construction activities continuing to operate after the issuance date of this permit, and authorized under NPDES general permit TXR100000 (issued July 6, 1998, FR 36490), must submit an NOI to obtain authorization under this general permit within 90 days of the issuance date of this general permit. During this interim period, as a requirement of this TPDES permit, the operator must continue to meet the conditions and requirements of the federal NPDES permit. If the construction activity is completed prior to this 90-day deadline, and the site would otherwise qualify for termination of coverage under that federal NPDES permit, the operator must notify the executive director of the TCEQ in writing within 30 days of that condition.

2. Small Construction Activities

- (a) New Construction - Discharges from sites where the commencement of construction occurs on or after the issuance date of this general permit must be authorized, either under this general permit or a separate TPDES permit, prior to the commencement of those construction activities.
- (b) Ongoing Construction - Discharges from ongoing small construction activities that commenced prior to March 10, 2003, and that would not meet the conditions to qualify for termination of this permit as described in Part II.E. of this general permit, must be authorized, either under this general permit or a separate TPDES permit, prior to March 10, 2003.

Section D. Obtaining Authorization to Discharge

1. Small construction activities are determined to occur during periods of low potential for erosion, and operators of these sites may be automatically authorized under this general permit and not required to develop a storm water pollution prevention plan or submit a notice of intent (NOI), provided:
 - (a) the construction activity occurs in a county listed in Appendix A;
 - (b) the construction activity is initiated and completed, including either final or temporary stabilization of all disturbed areas, within the time frame identified in Appendix A for the location of the construction site;
 - (c) all temporary stabilization is adequately maintained to effectively reduce or prohibit erosion, final stabilization activities have been initiated and a condition, of final stabilization is completed no later than 30 days following the end date of the time frame identified in Appendix A for the location of the construction site;
 - (d) the permittee signs a completed construction site notice (Attachment 1 of this general permit), including the certification statement;
 - (e) a signed copy of the construction site notice is posted at the construction site in a location where it is readily available for viewing by the general public, local, state, and federal authorities prior to commencing construction activities, and maintained in that location until completion of the construction activity;
 - (f) a copy of the signed and certified construction site notice is provided to the operator of any municipal separate storm sewer system receiving the discharge at least two days prior to commencement of construction activities; and
 - (g) any supporting concrete batch plant or asphalt batch plant is separately authorized for discharges of storm water runoff or other non-storm water discharges under an individual TPDES permit, another TPDES general permit or under an individual TCEQ permit where storm water and non-storm water is disposed of by evaporation or irrigation (discharges are adjacent to water in the state).
2. Operators of small construction activities not described in Part II.D.1. above may be automatically authorized under this general permit, and operators of these sites are not required to submit an NOI provided they:
 - (a) develop a SWP3 according to the provisions of this general permit, that covers either the entire site or all portions of the site for which the applicant

is the operator, and implement that plan prior to commencing construction activities;

- (b) sign a completed construction site notice (Attachment 2 of this general permit);
 - (c) post a signed copy of the construction site notice at the construction site in a location where it is readily available for viewing by the general public, local, state, and federal authorities, prior to commencing construction activities, and maintain the notice in that location until completion of the construction activity; and
 - (d) provide a copy of the signed and certified construction site notice to the operator of any municipal separate storm sewer system receiving the discharge at least two days prior to commencement of construction activities.
3. Operators of all other construction activities that qualify for coverage under this general permit must:
- (a) develop a SWP3 according to the provisions of this general permit, that covers either the entire site or all portions of the site for which the applicant is the operator, and implement that plan prior to commencing construction activities;
 - (b) submit a Notice of Intent (NOI), using a form provided by the executive director, at least 2 days prior to commencing construction activities; or
 - (c) if the operator changes, or an additional operator is added after the initial NOI is submitted, the new operator must submit an NOI at least two (2) days before assuming operational control;
 - (d) post a copy of the NOI at the construction site in a location where it is readily available for viewing prior to commencing construction activities, and maintain the notice in that location until completion of the construction activity;
 - (e) provide a copy of the signed NOI to the operator of any municipal separate storm sewer system receiving the discharge, at least two (2) days prior to commencing construction activities; and
 - (f) implement the SWP3 prior to beginning construction activities.

4. Effective Date of Coverage

- (a) Operators of construction activities described in either Part II. D.1. or D.2. are authorized immediately following compliance with the conditions of Part II. D.1. or D.2. that are applicable to the construction activity.
- (b) Operators of all other construction activities eligible for coverage under this general permit, unless otherwise notified by the executive director, are provisionally authorized two (2) days from the date that a completed NOI is postmarked for delivery to the TCEQ. If electronic submission of the NOI is provided, and unless otherwise notified by the executive director, operators are provisionally authorized 24 hours following confirmation of receipt of the NOI by the TCEQ. Authorization is non-provisional when the executive director finds the NOI is administratively complete and an authorization number is issued for the activity.
- (c) Operators are not prohibited from submitting late NOIs or posting late notices to obtain authorization under this general permit. The TCEQ reserves the right to take appropriate enforcement actions for any unpermitted activities that may have occurred between the time construction commenced and authorization is obtained.

5. Notice of Change (NOC) Letter

If the operator becomes aware that it failed to submit any relevant facts, or submitted incorrect information in an NOI, the correct information must be provided to the executive director in a NOC letter within 14 days after discovery. If relevant information provided in the NOI changes, a NOC letter must be submitted within 14 days of the change. A copy of the NOC must be provided to the operator of any MS4 receiving the discharge.

6. Signatory Requirement for NOI Forms, Notice of Termination (NOT) Forms, NOC Letters, and Construction Site Notices

NOI forms, NOT forms, NOC letters, and Construction Site Notices must be signed according to 30 TAC § 305.44 (relating to Application for Permit).

7. Contents of the NOI

The NOI form shall require, at a minimum, the following information:

- (a) the name, address, and telephone number of the operator filing the NOI for permit coverage;
- (b) the name (or other identifier), address, county, and latitude/longitude of the construction project or site;

- (c) number of acres that will be disturbed (estimated to the largest whole number);
- (d) whether the project or site is located on Indian Country lands;
- (e) confirmation that a SWP3 has been developed and that the SWP3 will be compliant with any applicable local sediment and erosion control plans; and
- (f) name of the receiving water(s).

Section E. Application to Terminate Coverage

Each operator that has submitted an NOI for authorization under this general permit must apply to terminate that authorization following the conditions described in this section of the general permit. Authorization must be terminated by submitting a Notice of Termination (NOT) on a form supplied by the executive director. Authorization to discharge under this permit terminates at midnight on the day the NOT is postmarked for delivery to the TCEQ. If electronic submission of the NOT is provided, authorization to discharge under this permit terminates immediately following confirmation of receipt of the NOT by the TCEQ. Compliance with the conditions and requirements of this permit is required until an NOT is submitted.

1. Notice of Termination Required

The NOT must be submitted to TCEQ, and a copy of the NOT provided to the operator of any MS4 receiving the discharge, within thirty (30) days, after:

- (a) final stabilization has been achieved on all portions of the site that is the responsibility of the permittee; or
- (b) another permitted operator has assumed control over all areas of the site that have not been finally stabilized; and
- (c) all silt fences and other temporary erosion controls have either been removed, scheduled for removal as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage. Erosion controls that are designed to remain in place for an indefinite period, such as mulches and fiber mats, are not required to be removed or scheduled for removal.

2. Minimum Contents of the NOT

The NOT form shall require, at a minimum, the following information:

- (a) if authorization was granted following submission of a NOI, the permittees site-specific TPDES general permit number for the construction site;

- (b) an indication of whether the construction activity is completed or if the permittee is simply no longer an operator at the site;
- (c) the name, address and telephone number of the permittee submitting the NOT;
- (d) the name (or other identifier), address, county, and latitude/longitude of the construction project or site; and
- (e) a signed certification that either all storm water discharges requiring authorization under this general permit will no longer occur, or that the applicant to terminate coverage is no longer the operator of the facility or construction site, and that all temporary structural erosion controls have either been removed, will be removed on a schedule defined in the SWP3, or transferred to a new operator if the new operator has applied for permit coverage. Erosion controls that are designed to remain in place for an indefinite period, such as mulches and fiber mats, are not required to be removed or scheduled for removal.

Section F. Waivers from Coverage

The executive director may waive the otherwise applicable requirements of this general permit for storm water discharges from small construction activities under the terms and conditions described in this section.

1. Waiver Applicability and Coverage

Operators of small construction activities may apply for and receive a waiver from the requirements to obtain authorization under this general permit where:

- (a) the calculated rainfall erosivity R factor for the entire period of the construction project is less than five (5);
- (b) the operator submits a signed waiver certification form, supplied by the executive director, certifying that the construction activity will commence and be completed within a period when the value of the calculated rainfall erosivity R factor is less than five (5); and
- (c) the waiver certification form is submitted to the TCEQ at least two (2) days before construction activity begins.

2. Effective Date of Waiver

Operators of small construction activities are provisionally waived from the otherwise applicable requirements of this general permit two (2) days from the date that a completed waiver certification form is postmarked for delivery to TCEQ.

3. Activities Extending Beyond the Waiver Period

If a construction activity extends beyond the approved waiver period due to circumstances beyond the control of the operator, the operator must either:

- (a) recalculate the rainfall erosivity factor R factor using the original start date and a new projected ending date, and if the R factor is still under five (5), submit a new waiver certification form at least two (2) days before the end of the original waiver period; or
- (b) obtain authorization under this general permit according to the requirements delineated in either Part II.D.2. or Part II.D.3. at least two (2) days before the end of the approved waiver period.

Section G. Alternative TPDES Permit Coverage

1. Individual Permit Alternative

Any discharge eligible for coverage under this general permit may alternatively be authorized under an individual TPDES permit according to 30 TAC Chapter 305 (relating to Consolidated Permits). Applications for individual permit coverage should be submitted at least three hundred and thirty (330) days prior to commencement of construction activities to ensure timely issuance.

2. Individual Permit Required

The executive director may suspend an authorization or NOI in accordance with the procedures set forth in 30 TAC Chapter 205, including the requirement that the executive director provide written notice to the permittee. The executive director may require an operator of a construction site, otherwise eligible for authorization under this general permit, to apply for an individual TPDES permit because of:

- (a) the conditions of an approved TMDL or TMDL implementation plan;
- (b) the activity is determined to cause a violation of water quality standards or is found to cause, or contribute to, the loss of a designated use of surface water in the state: and
- (c) any other considerations defined in 30 TAC Chapter 205 would include the provision at 30 TAC § 205.4(c)(3)(D), which allows TCEQ to deny authorization under the general permit and require an individual permit if a discharger “has been determined by the executive director to have been out of compliance with any rule, order, or permit of the commission, including non-payment of fees assessed by the executive director.”

3. Any discharge eligible for authorization under this general permit may alternatively be authorized under a separate, applicable general permit according to 30 TAC Chapter 205 (relating to General Permits for Waste Discharges).

Section H. Permit Expiration

This general permit shall be issued for a term not to exceed five (5) years. Following public notice and comment, as provided by 30 TAC § 205.3 (relating to Public Notice, Public Meetings, and Public Comment), the commission may amend, revoke, cancel, or renew this general permit. If the TCEQ publishes a notice of its intent to renew or amend this general permit before the expiration date, the permit will remain in effect for existing, authorized, discharges until the commission takes final action on the permit. Upon issuance of a renewed or amended permit, permittees may be required to submit an NOI within 90 days following the effective date of the renewed or amended permit, unless that permit provides for an alternative method for obtaining authorization.

In the event that the general permit is not renewed, discharges that are authorized under the general permit must obtain either a TPDES individual permit or coverage under an alternative general permit.

Part III. Storm Water Pollution Prevention Plans (SWP3)

Storm water pollution prevention plans must be prepared for storm water discharges that will reach Waters of the United States, including discharges to MS4 systems and privately owned separate storm sewer systems that drain to Waters of the United States, to identify and address potential sources of pollution that are reasonably expected to affect the quality of discharges from the construction site, including off-site material storage areas, overburden and stockpiles of dirt, borrow areas, equipment staging areas, vehicle repair areas, fueling areas, etc., used solely by the permitted project. The SWP3 must describe and ensure the implementation of practices that will be used to reduce the pollutants in storm water discharges associated with construction activity at the construction site and assure compliance with the terms and conditions of this permit.

Individual operators at a site may develop separate SWP3s that cover only their portion of the project provided reference is made to the other operators at the site. Where there is more than one SWP3 for a site, permittees must coordinate to ensure that BMPs and controls are consistent, and do not negate or impair the effectiveness of each other. Regardless of whether a single comprehensive SWP3 is developed, or separate SWP3s are developed for each operator, it is the responsibility of each operator to ensure that compliance with the terms and conditions of this general permit is met in the areas of the construction site where that operator has operational control over construction plans and specifications or day-to-day operational control.

Section A. Shared SWP3 Development

For more effective coordination of BMPs and opportunities for cost sharing, a cooperative effort by the different operators at a site is encouraged. Operators must independently submit an NOI and obtain authorization, but may work together to prepare and implement a single comprehensive SWP3 for the entire construction site.

1. The SWP3 must clearly list the name and, for large construction activities, the general permit authorization numbers, for each operator that participates in the shared SWP3. Until the TCEQ responds to receipt of the NOI with a general permit authorization number, the SWP3 must specify the date that the NOI was submitted to TCEQ by each operator. Each participant in the shared plan must also sign the SWP3.
2. The SWP3 must clearly indicate which operator is responsible for satisfying each shared requirement of the SWP3. If the responsibility for satisfying a requirement is not described in the plan, then each permittee is entirely responsible for meeting the requirement within the boundaries of the construction site where they perform construction activities. The SWP3 must clearly describe responsibilities for meeting each requirement in shared or common areas.

Section B. Responsibilities of Operators

1. Operators with Control Over Construction Plans and Specifications

All operators with operational control over construction plans and specifications to the extent necessary to meet the requirements and conditions of this general permit must:

- (a) ensure the project specifications allow or provide that adequate BMPs may be developed to meet the requirements of Part III of this general permit;
- (b) ensure that the SWP3 indicates the areas of the project where they have operational control over project specifications (including the ability to make modifications in specifications);
- (c) ensure all other operators affected by modifications in project specifications are notified in a timely manner such that those operators may modify best management practices as are necessary to remain compliant with the conditions of this general permit; and
- (d) ensure that the SWP3 for portions of the project where they are operators indicates the name and TPDES permit numbers for permittees with the day-to-day operational control over those activities necessary to ensure compliance with the SWP3 and other permit conditions. In the case that responsible parties have not been identified, the permittee with operational control over project specifications must be considered to be the responsible party until such time as the authority is transferred to another party and the plan is updated.

2. Operators with Day-to-Day Operational Control

Operators with day-to-day operational control of those activities at a project that are necessary to ensure compliance with a SWP3 and other permit conditions must:

- (a) ensure that the SWP3 for portions of the project where they are operators meets the requirements of this general permit;
- (b) ensure that the SWP3 identifies the parties responsible for implementation of best management practices described in the plan;
- (c) ensure that the SWP3 indicates areas of the project where they have operational control over day-to-day activities;
- (d) ensure that the SWP3 indicates, for areas where they have operational control over day-to-day activities, the name and TPDES permit number of the parties with operational control over project specifications (including the ability to make modifications in specifications).

Section C. Deadlines for SWP3 Preparation and Compliance

- 1. The SWP3 must be:
 - (a) completed prior to obtaining authorization under this general permit;
 - (b) implemented prior to commencing construction activities that result in soil disturbance;
 - (c) updated as necessary to reflect the changing conditions of new operators, new areas of responsibility, and changes in best management practices; and
 - (d) prepared so that it provides for compliance with the terms and conditions of this general permit.

Section D. Plan Review and Making Plans Available

- 1. The SWP3 must be retained on-site at the construction site or, if the site is inactive or does not have an on-site location to store the plan, a notice must be posted describing the location of the SWP3. The SWP3 must be made readily available at the time of an on-site inspection to: the executive director; a federal, state, or local agency approving sediment and erosion plans, grading plans, or storm water management plans; local government officials; and the operator of a municipal separate storm sewer receiving discharges from the site.
- 2. Operators of a large construction activity obtaining authorization to discharge through submission of a NOI must post a notice near the main entrance of the

construction site. If the construction project is a linear construction project (e.g. pipeline, highway, etc.), the notice must be placed in a publicly accessible location near where construction is actively underway. Notice for these linear sites may be relocated, as necessary, along the length of the project. The notice must be readily available for viewing by the general public, local, state, and federal authorities, and contain the following information:

- (a) the TPDES general permit number for the project (or a copy of the NOI that was submitted to the TCEQ if a permit number has not yet been assigned);
 - (b) the name and telephone number of a representative for the operator;
 - (c) a brief description of the project; and
 - (d) the location of the SWP3.
3. This permit does not provide the general public with any right to trespass on a construction site for any reason, including inspection of a site; nor does this permit require that permittees allow members of the general public access to a construction site.

Section E. Keeping Plans Current

The permittee must revise or update the storm water pollution prevention plan whenever:

- 1. there is a change in design, construction, operation, or maintenance that has a significant effect on the discharge of pollutants and that has not been previously addressed in the SWP3; or
- 2. results of inspections or investigations by site operators, operators of a municipal separate storm sewer system receiving the discharge, authorized TCEQ personnel, or a federal, state or local agency approving sediment and erosion plans indicate the SWP3 is proving ineffective in eliminating or significantly minimizing pollutants in discharges authorized under this general permit.

Section F. Contents of SWP3

The SWP3 must include, at a minimum, the information described in this section.

- 1. A site description, or project description must be developed to include:
 - (a) a description of the nature of the construction activity, potential pollutants and sources;
 - (b) a description of the intended schedule or sequence of major activities that will disturb soils for major portions of the site;

- (c) the total number of acres of the entire property and the total number of acres where construction activities will occur, including off-site material storage areas, overburden and stockpiles of dirt, and borrow areas;
 - (d) data describing the soil or the quality of any discharge from the site;
 - (e) a map showing the general location of the site (e.g. a portion of a city or county map);
 - (f) a detailed site map (or maps) indicating the following:
 - (i) drainage patterns and approximate slopes anticipated after major grading activities;
 - (ii) areas where soil disturbance will occur;
 - (iii) locations of all major structural controls either planned or in place;
 - (iv) locations where stabilization practices are expected to be used;
 - (v) locations of off-site material, waste, borrow, fill, or equipment storage areas;
 - (vi) surface waters (including wetlands) either adjacent or in close proximity; and
 - (vii) locations where storm water discharges from the site directly to a surface water body.
 - (g) the location and description of asphalt plants and concrete plants providing support to the construction site and authorized under this general permit;
 - (h) the name of receiving waters at or near the site that will be disturbed or that will receive discharges from disturbed areas of the project; and
 - (i) a copy of this TPDES general permit.
2. The SWP3 must describe the best management practices that will be used to minimize pollution in runoff. The description must identify the general timing or sequence for implementation. At a minimum, the description must include the following components:
- (a) Erosion and Sediment Controls
 - (i) Erosion and sediment controls must be designed to retain sediment on-site to the extent practicable with consideration for local

topography, soil type, and rainfall. Controls must also be designed and utilized to reduce the offsite transport of suspended sediments and other pollutants if it is necessary to pump or channel standing water from the site.

- (ii) Control measures must be properly selected, installed, and maintained according to the manufacturer's or designer's specifications. If periodic inspections or other information indicates a control has been used incorrectly, or that the control is performing inadequately, the operator must replace or modify the control as soon as practicable after discovery that the control has been used incorrectly, is performing inadequately, or is damaged.
- (iii) Sediment must be removed from sediment traps and sedimentation ponds no later than the time that design capacity has been reduced by 50%.
- (iv) If sediment escapes the site, accumulations must be removed at a frequency to minimize further negative effects, and whenever feasible, prior to the next rain event.
- (v) Controls must be developed to limit, to the extent practicable, offsite transport of litter, construction debris, and construction materials.

(b) Stabilization Practices

The SWP3 must include a description of interim and permanent stabilization practices for the site, including a schedule of when the practices will be implemented. Site plans should ensure that existing vegetation is preserved where it is possible.

- (i) Stabilization practices may include but are not limited to: establishment of temporary vegetation, establishment of permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of existing trees and vegetation, and other similar measures.
- (ii) The following records must be maintained and either attached to or referenced in the SWP3, and made readily available upon request to the parties in Part III.D.1 of this general permit:
 - (a) the dates when major grading activities occur;
 - (b) the dates when construction activities temporarily or permanently cease on a portion of the site; and

- (c) the dates when stabilization measures are initiated.
- (iii) Stabilization measures must be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, and except as provided in (a) through (c) below, must be initiated no more than fourteen (14) days after the construction activity in that portion of the site has temporarily or permanently ceased.
 - (a) Where the initiation of stabilization measures by the 14th day after construction activity temporarily or permanently ceased is precluded by snow cover or frozen ground conditions, stabilization measures must be initiated as soon as practicable.
 - (b) Where construction activity on a portion of the site is temporarily ceased, and earth disturbing activities will be resumed within twenty-one (21) days, temporary stabilization measures do not have to be initiated on that portion of site.
 - (c) In arid areas (areas with an average rainfall of 0 to 10 inches), semiarid areas (areas with an average annual rainfall of 10 to 20 inches), and areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased is precluded by seasonably arid conditions, stabilization measures must be initiated as soon as practicable.

3. Structural Control Practices

The SWP3 must include a description of any structural control practices used to divert flows away from exposed soils, to limit the contact of runoff with disturbed areas, or to lessen the off-site transport of eroded soils.

- (a) Sediment basins are required, where feasible for common drainage locations that serve an area with ten (10) or more acres disturbed at one time, a temporary (or permanent) sediment basin that provides storage for a calculated volume of runoff from a 2-year, 24-hour storm from each disturbed acre drained, or equivalent control measures, shall be provided where attainable until final stabilization of the site. Where rainfall data is not available or a calculation cannot be performed, a temporary (or permanent) sediment basin providing 3,600 cubic feet of storage per acre drained is required where attainable until final stabilization of the site. When calculating the volume of runoff from a 2-year, 24-hour storm event, it is not required to include the flows from offsite areas and flow from onsite areas that are either undisturbed or have already undergone final stabilization, if

these flows are diverted around both the disturbed areas of the site and the sediment basin. In determining whether installing a sediment basin is feasible, the permittee may consider factors such as site soils, slope, available area on site, public safety, precipitation patterns, site geometry, site vegetation, infiltration capacity, geotechnical factors, depth to groundwater and other similar considerations. Where sediment basins are not feasible, equivalent control measures, which may include a series of smaller sediment basins, must be used. At a minimum, silt fences, vegetative buffer strips, or equivalent sediment controls are required for all down slope boundaries (and for those side slope boundaries deemed appropriate as dictated by individual site conditions) of the construction area.

- (b) Sediment traps and sediment basins may also be used to control solids in storm water runoff for drainage locations serving less than ten (10) acres. At a minimum, silt fences, vegetative buffer strips, or equivalent sediment controls are required for all down slope boundaries (and for those side slope boundaries deemed appropriate as dictated by individual site conditions) of the construction. Alternatively, a sediment basin that provides storage for a calculated volume of runoff from a 2-year, 24-hour storm from each disturbed acre drained, or equivalent control measures, may be provided or where rainfall data is not available or a calculation cannot be performed, a temporary (or permanent) sediment basin providing 3,600 cubic feet of storage per acre drained may be provided.

4. Permanent Storm Water Controls

A description of any measures that will be installed during the construction process to control pollutants in storm water discharges that will occur after construction operations have been completed must be included in the SWP3. Permittees are only responsible for the installation and maintenance of storm water management measures prior to final stabilization of the site or prior to submission of an NOT.

5. Other Controls

- (a) Off-site vehicle tracking of sediments and the generation of dust must be minimized.
- (b) The SWP3 must include a description of construction and waste materials expected to be stored on-site and a description of controls to reduce pollutants from these materials.
- (c) The SWP3 must include a description of pollutant sources from areas other than construction (including storm water discharges from dedicated asphalt plants and dedicated concrete plants), and a description of controls and measures that will be implemented at those sites to minimize pollutant discharges.

- (d) Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel to provide a non-erosive flow velocity from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected.

6. Approved State and Local Plans

- (a) Permittees must ensure the SWP3 is consistent with requirements specified in applicable sediment and erosion site plans or site permits, or storm water management site plans or site permits approved by federal, state, or local officials.
- (b) SWP3s must be updated as necessary to remain consistent with any changes applicable to protecting surface water resources in sediment erosion site plans or site permits, or storm water management site plans or site permits approved by state or local official for which the permittee receives written notice.

7. Maintenance

All erosion and sediment control measures and other protective measures identified in the SWP3 must be maintained in effective operating condition. If through inspections the permittee determines that BMPs are not operating effectively, maintenance must be performed before the next anticipated storm event or as necessary to maintain the continued effectiveness of storm water controls. If maintenance prior to the next anticipated storm event is impracticable, maintenance must be scheduled and accomplished as soon as practicable. Erosion and sediment controls that have been intentionally disabled, run-over, removed, or otherwise rendered ineffective must be replaced or corrected immediately upon discovery.

8. Inspections of Controls

In the event of flooding or other uncontrollable situations which prohibit access to the inspection sites, inspections must be conducted as soon as access is practicable

- (a) Personnel provided by the permittee and familiar with the SWP3 must inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, and structural controls for evidence of, or the potential for, pollutants entering the drainage system. Sediment and erosion control measures identified in the SWP3 must be inspected to ensure that they are operating correctly. Locations where vehicles enter or exit the site must be inspected for evidence of off-site sediment tracking. Inspections must be conducted at least once every fourteen (14) calendar days and within twenty four (24) hours of the end of a storm event of 0.5 inches or greater.

Where sites have been finally or temporarily stabilized, where runoff is unlikely due to winter conditions (e.g. site is covered with snow, ice, or frozen ground exists), or during seasonal arid periods in arid areas (areas with an average annual rainfall of 0 to 10 inches) and semi-arid areas (areas with an average annual rainfall of 10 to 20 inches), inspections must be conducted at least once every month.

As an alternative to the above-described inspection schedule of once every fourteen (14) calendar days and within twenty four (24) hours of a storm event of 0.5 inches or greater, the SWP3 may be developed to require that these inspections will occur at least once every seven (7) calendar days. If this alternative schedule is developed, the inspection must occur on a specifically defined day, regardless of whether or not there has been a rainfall event since the previous inspection.

- (b) Utility line installation, pipeline construction, and other examples of long, narrow, linear construction activities may provide inspection personnel with limited access to the areas described in Part III.F.8.(a) above. Inspection of these areas could require that vehicles compromise temporarily or even permanently stabilized areas, cause additional disturbance of soils, and increase the potential for erosion. In these circumstances, controls must be inspected at least once every fourteen (14) calendar days and within twenty four (24) hours of the end of a storm event of 0.5 inches, but representative inspections may be performed. For representative inspections, personnel must inspect controls along the construction site for 0.25 mile above and below each access point where a roadway, undisturbed right-of-way, or other similar feature intersects the construction site and allows access to the areas described in Part III.F.8.(a) above. The conditions of the controls along each inspected 0.25 mile segment may be considered as representative of the condition of controls along that reach extending from the end of the 0.25 mile segment to either the end of the next 0.25 mile inspected segment, or to the end of the project, whichever occurs first.

As an alternative to the above-described inspection schedule of once every fourteen (14) calendar days and within twenty four (24) hours of a storm event of 0.5 inches or greater, the SWP3 may be developed to require that these inspections will occur at least once every seven (7) calendar days. If this alternative schedule is developed, the inspection must occur on a specifically defined day, regardless of whether or not there has been a rainfall event since the previous inspection.

- (c) The SWP3 must be modified based on the results of inspections, as necessary, to better control pollutants in runoff. Revisions to the SWP3 must be completed within seven (7) calendar days following the inspection. If existing BMPs are modified or if additional BMPs are necessary, an implementation schedule must be described in the SWP3 and wherever

possible those changes implemented before the next storm event. If implementation before the next anticipated storm event is impracticable, these changes must be implemented as soon as practicable.

- (d) A report summarizing the scope of the inspection, names and qualifications of personnel making the inspection, the dates of the inspection, and major observations relating to the implementation of the SWP3 must be made and retained as part of the SWP3. Major observations should include: The locations of discharges of sediment or other pollutants from the site; locations of BMPs that need to be maintained; locations of BMPs that failed to operate as designed or proved inadequate for a particular location; and locations where additional BMPs are needed.

Actions taken as a result of inspections must be described within, and retained as a part of, the SWP3. Reports must identify any incidents of non-compliance. Where a report does not identify any incidents of non-compliance, the report must contain a certification that the facility or site is in compliance with the SWP3 and this permit. The report must be signed by the person and in the manner required by 30 TAC § 305.128 (relating to Signatories to Reports)

9. The SWP3 must identify and ensure the implementation of appropriate pollution prevention measures for all eligible non-storm water components of the discharge.

Part IV. Numeric Effluent Limitations

Section A. Limitations

All discharges of storm water runoff from concrete batch plants that qualify for coverage, and that are authorized to discharge storm water under the provisions of this general permit must be monitored at the following monitoring frequency and comply with the following numeric effluent limitations:

<u>Parameter</u>	<u>Limitations</u> <u>Daily Maximum</u>	<u>Monitoring</u> <u>Frequency</u>
Total Suspended Solids	65 mg/l	1/Year*
Oil and Grease	15 mg/l	1/Year*
pH	between 6 and 9 standard units	1/Year*

* If discharge occurs.

Section B. Reporting Requirements

Results of monitoring for determining compliance with numeric effluent limitations must be recorded on a discharge monitoring report (DMR). The DMR must either be an original EPA No. 3320-1 form (Attachment 3 of this general permit), a duplicate of the form, or as otherwise provided by the executive director. Monitoring must be conducted prior to December 31st for each annual

monitoring period. A copy of the DMR must either be retained at the facility or shall be made readily available for review by authorized TCEQ personnel upon request, by March 31st following the end of each annual monitoring period. If the results indicate the violation of one or more of these numeric limitations, the permittee must also submit the DMR to the TCEQ's Information Resources Center (MC 212) by March 31st of each annual monitoring period.

Part V. Retention of Records

The permittee must retain the following records for a minimum period of three (3) years from the date that a NOT is submitted as required by Part II.D. For activities that are not required to submit an NOT, records shall be retained for a minimum period of three (3) years from the date that either: final stabilization has been achieved on all portions of the site that is the responsibility of the permittee; or another permitted operator has assumed control according to over all areas of the site that have not been finally stabilized. Records include:

1. A copy of the SWP3 plan.
2. All reports and actions required by this permit, including a copy of the construction site notice.
3. All data used to complete the NOI, if an NOI is required for coverage under this general permit.

Part VI. Standard Permit Conditions

1. The permittee has a duty to comply with all permit conditions. Failure to comply with any permit condition is a violation of the permit and statutes under which it was issued, and is grounds for enforcement action, for terminating coverage under this general permit, or for requiring a discharger to apply for and obtain an individual TPDES permit.
2. Authorization under this general permit may be suspended or revoked for cause. Filing a notice of planned changes or anticipated non-compliance by the permittee does not stay any permit condition. The permittee must furnish to the executive director, upon request and within a reasonable time, any information necessary for the executive director to determine whether cause exists for revoking, suspending, or terminating authorization under this permit. Additionally, the permittee must provide to the executive director, upon request, copies of all records that the permittee is required to maintain as a condition of this general permit.
3. It is not a defense for a discharger in an enforcement action that it would have been necessary to halt or reduce the permitted activity to maintain compliance with the permit conditions.
4. Inspection and entry shall be allowed under Texas Water Code Chapters 26-28, Health and Safety Code §§ 361.032-361.033 and 361.037, and 40 Code of Federal Regulations (CFR) §122.41(i). The statement in Texas Water Code § 26.014 that commission entry of a facility shall occur according to an establishment's rules and regulations concerning safety, internal security, and fire protection is not grounds for denial or restriction of entry to any part of the

facility or site, but merely describes the commission's duty to observe appropriate rules and regulations during an inspection.

5. The discharger is subject to administrative, civil, and criminal penalties, as applicable, under Texas Water Code §§ 26.136, 26.212, and 26.213 for violations including but not limited to the following:
 - a. negligently or knowingly violating CWA, §§ 301, 302, 306, 307, 308, 318, or 405, or any condition or limitation implementing any sections in a permit issued under CWA, § 402, or any requirement imposed in a pretreatment program approved under CWA, §§ 402(a)(3) or 402(b)(8);
 - b. knowingly making any false statement, representation, or certification in any record or other document submitted or required to be maintained under a permit, including monitoring reports or reports of compliance or noncompliance.
6. All reports and other information requested by the executive director must be signed by the person and in the manner required by 30 TAC § 305.128 (relating to Signatories to Reports).
7. Authorization under this general permit does not convey property or water rights of any sort and does not grant any exclusive privilege.

Part VII. Fees

Section A. Application Fees

An application fee of \$100 must be submitted with each NOI for coverage of a large construction activity. A fee is not required for submission of an NOT or NOC letter.

Section B. Water Quality Fees

Large construction activities authorized under this general permit must pay an annual Water Quality Fee of \$100 under Texas Water Code 26.0291 and according to TAC Chapter 205 (relating to General Permits for Waste Discharges).

Appendix A.

Periods of Low Erosion Potential by County

Start Date - End Date

Dec. 15 - Feb. 14

Archer
Baylor
Brown
Callahan
Childress
Coke
Coleman
Concho
Cottle
Dimmit
Eastland
Edwards
Fisher
Foard
Hardeman
Haskell
Irion
Jones
Kerr
Kimble
King
Kinney
Knox
Mason
Maverick
McCulloch
Menard
Nolan
Real
Runnels
Schleicher
Shackelford
Stephens
Stonewall
Sutton
Taylor
Throckmorton
Tom Green
Uvalde
Wichita
Wilbarger
Young
Zavala

Start Date - End Date

Nov. 15 - Apr. 30

Andrews
Armstrong
Borden
Brewster
Briscoe
Carson
Castro
Crane
Crosby
Dawson
Deaf Smith
Ector
Floyd
Gaines
Garza
Glasscock
Hale
Hansford
Hartley
Howard
Hutchinson
Lubbock
Lynn
Martin
Midland
Mitchell
Moore
Oldham
Pecos
Potter
Randall
Reagan
Scurry
Sherman
Sterling
Swisher
Terrell
Terry
Upton

Start Date - End Date

Feb. 1 - Mar. 30
Hall

Start Date - End Date

Nov. 15 - Jan. 14 or Feb. 1 - Mar. 30

Crockett
Dickens
Kent
Motley
Val Verde

Start Date - End Date

Nov. 1 - Apr. 14 or Nov. 15 - Apr. 30

Dallam
Hockley
Lamb
Parmer
Ward

Start Date - End Date

Nov. 1 - Apr. 30 or Nov. 15 - May. 14

Bailey
Cochran
Jeff Davis
Loving
Presidio
Reeves
Winkler
Yoakum

Start Date - End Date

Nov. 1 - May. 14

Culberson
Hudspeth

Start Date - End Date

**Jan. 1 - Jul. 14 or May. 15 - Jul. 31 or
Jun. 1 - Aug. 14 or Jun. 15 - Sept. 14 or
Jul. 1 - Oct. 14 or Jul. 15 - Oct. 31 or
Aug. 1 - Apr. 30 or Aug. 15 - May. 14 or
Sept. 1 - May. 30 or Oct. 1 - Jun. 14 or
Nov. 1 - Jun. 30 or Nov. 15 - Jul. 14**
El Paso

Start Date - End Date

Jan. 1 - Mar. 30 or Dec. 1 - Feb. 28

Collingsworth Wheeler
Donley
Gray
Hemphill
Lipscomb
Ochiltree
Roberts



CONSTRUCTION SITE NOTICE

FOR THE

Texas Commission on Environmental Quality (TCEQ)

Storm Water Program

TPDES GENERAL PERMIT TXR150000

The following information is posted in compliance with **Part II.D.1.** of the TCEQ General Permit Number TXR150000 for discharges of storm water runoff from construction sites. Additional information regarding the TCEQ storm water permit program may be found on the internet at:

www.tnrc.state.tx.us/permitting/waterperm/wwperm/tpdestorm

Contact Name and Phone Number:	
Project Description: (Physical address or description of the site's location, estimated start date and projected end date, or date that disturbed soils will be stabilized)	

For Construction Sites Authorized Under Part II.D.1. the following certification must be completed:

I _____ (Typed or Printed Name Person Completing This Certification) certify under penalty of law that I have read and understand the eligibility requirements for claiming an authorization by waiver under Part II.D.1. of TPDES General Permit TXR150000 and agree to comply with the terms of this permit. Construction activities at this site shall occur within a time period listed in Appendix A of the TPDES general permit for this county, that period beginning on _____ and ending on _____. I understand that if construction activities continue past this period, all storm water runoff must be authorized under a separate provision of this general permit. A copy of this signed notice is supplied to the operator of the MS4 if discharges enter an MS4 system. I am aware there are significant penalties for providing false information or for conducting unauthorized discharges, including the possibility of fine and imprisonment for knowing violations.

Signature and Title

Date



CONSTRUCTION SITE NOTICE

FOR THE

Texas Commission on Environmental Quality (TCEQ)

Storm Water Program

TPDES GENERAL PERMIT TXR150000

The following information is posted in compliance with **Part II.D.2.** of the TCEQ General Permit Number TXR150000 for discharges of storm water runoff from construction sites. Additional information regarding the TCEQ storm water permit program may be found on the internet at:

www.tnrcc.state.tx.us/permitting/waterperm/wwperm/tpdestorm

Contact Name and Phone Number:	
Project Description: ((Physical address or description of the site's location, estimated start date and projected end date, or date that disturbed soils will be stabilized))	
Location of Storm Water Pollution Prevention Plan :	

For Construction Sites Authorized Under Part II.D.2. (Obtaining Authorization to Discharge) the following certification must be completed:

I _____ (Typed or Printed Name Person Completing This Certification) certify under penalty of law that I have read and understand the eligibility requirements for claiming an authorization under Part II.D.2. of TPDES General Permit TXR150000 and agree to comply with the terms of this permit. A storm water pollution prevention plan has been developed and implemented according to permit requirements. A copy of this signed notice is supplied to the operator of the MS4 if discharges enter an MS4 system. I am aware there are significant penalties for providing false information or for conducting unauthorized discharges, including the possibility of fine and imprisonment for knowing violations.

Signature and Title

Date

CONCRETE BATCH FACILITIES**STW/ TXR15_____ / CO**

PERMITTEE NAME/ADDRESS (Include Facility Name/Location if Different)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
(NPDES)

NAME

DISCHARGE MONITORING REPORT (DMR)

NOTE: Enter your permit number in the underlined space in the upper right hand corner of this page. Example: STW/TXR15 00123/ CO

ADDRESS

(2-16)

(17-19)

PERMIT NUMBER

DISCHARGE NUMBER

Mail to: TCEQ (MC 212)
P.O. Box 13087
Austin, TX 78711-3087FACILITY
LOCATION

MONITORING PERIOD

YEAR	MO	DAY	YEAR	MO	DAY
	01	01		12	31
(20-21)	(22-23)	(24-25)	(26-27)	(28-29)	(30-31)

PARAMETER (32-37)		(3 Card Only) (46-53) QUANTITY OR LOADING (54-61)			(4 Card Only) (38-45) QUALITY OR CONCENTRATION (46-53) (54-61)			NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)	
		AVERAGE	MAXIMUM	UNITS	MINIMUM	AVERAGE	MAXIMUM				UNITS
Total Suspended Solids	SAMPLE MEASUREMENT	*****	*****	*****	*****	*****					
	SAMPLE REQUIREMENT	*****	*****	*****	*****	*****	65 Daily Max	mg/l	1/Year	Grab	
Oil & Grease	SAMPLE MEASUREMENT	*****	*****	*****	*****	*****					
	SAMPLE REQUIREMENT	*****	*****	*****	*****	*****	15 Daily Max	mg/l	1/Year	Grab	
pH	SAMPLE MEASUREMENT	*****	*****	*****	*****	*****					
	SAMPLE REQUIREMENT	*****	*****	*****	*****	*****	6.0 - 9.0 Range	S.U.	1/Year	Grab	
	SAMPLE MEASUREMENT										
	SAMPLE REQUIREMENT										
NAME/TITLE PRINCIPAL EXECUTIVE OFFICER		<small>I CERTIFY UNDER PENALTY OF LAW THAT THIS DOCUMENT AND ALL ATTACHMENTS WERE PREPARED UNDER MY DIRECTION OR SUPERVISION IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHER AND EVALUATE THE INFORMATION SUBMITTED, BASED ON MY INQUIRY OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM, OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR GATHERING THE INFORMATION. THE INFORMATION SUBMITTED IS, TO THE BEST OF MY KNOWLEDGE AND BELIEF, TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS.</small>			SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT		TELEPHONE		DATE		
TYPED OR PRINTED							AREA CODE	NUMBER	YEAR	MO	DAY

COMMENTS AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)



Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR150000)

For help completing this application, read the TXR150000 NOI Instructions ([TCEQ-20023-Instructions](#)).

TCEQ Office Use Only

TPDES Permit Number: TXR15* * * * * - NO

GIN Number: * * * * *

A. TPDES Permit Number: TXR15

B. Construction Site Operator

Customer Reference Number: CN

Name:

Mailing Address:

City:

State:

Zip Code:

Country Mailing Information (*if outside USA*) Territory:

Country Code:

Postal Code:

Phone Number:

Extension:

Fax Number:

E-mail Address:

C. Project / Site Information

Regulated Entity Reference Number: RN

Name:

Physical Address:

Location Access Description:

City:

County:

Zip Code:

D. Contact - If the TCEQ needs additional information regarding this termination, who should be contacted?

Name:

Title:

Phone Number:

Extension:

Fax Number:

E-mail Address:

E. Certification

I certify under penalty of law that authorization under the TPDES Construction General Permit (TXR150000) is no longer necessary based on the provisions of the general permit. I understand that by submitting this Notice of Termination, I am no longer authorized to discharge storm water associated with construction activity under the general permit TXR150000, and that discharging pollutants in storm water associated with construction activity to waters of the U.S. is unlawful under the Clean Water Act where the discharge is not authorized by a TPDES permit. I also understand that the submittal of this Notice of Termination does not release an operator from liability for any violations of this permit or the Clean Water Act.

Construction Site Operator Representative:

Prefix:

First:

Middle:

Last:

Suffix:

Title:

Signature: _____ Date: _____

If you have questions on how to fill out this form or about the storm water program, please contact us at (512) 239-4671. Individuals are entitled to request and review their personal information that the agency gathers on its forms. They may also have any errors in their information corrected. To review such information, contact us at (512) 239-3282.

The completed NOT must be mailed to the following address:

**Texas Commission on Environmental Quality
Storm Water & General Permits Team; MC - 228
P.O. Box 13087
Austin, Texas 78711-3087**

Completing the Notice of Intent for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR150000)

A. Construction Site Operator Information

Check boxes and Customer Reference Number

These boxes designate the operator's status as a TCEQ "customer"—in other words, an individual or business that is involved in an activity that we regulate. We assign each customer a number that begins with "CN," followed by nine digits. **This is not a permit number, registration number, or license number.** In the remainder of this section, we will use "this customer" to mean the operator for Part A of the form.

- If this customer has not been assigned a Customer Reference Number or if this number is unknown, check "New" and leave the space for the Customer Reference Number blank.
- If this customer has already been assigned this number, enter the operator's Customer Reference Number and:
 - Check "No Change" if all the remaining customer information is the same as previously reported. However, you must still complete most blanks in this form for this notice of intent to be valid.
 - If this customer's information has changed since the last time it was reported to the TCEQ, check neither box and complete the remainder of this notice of intent.
- **Do not enter a permit number, registration number, or license number in place of the Customer Reference Number.**

Name

Enter the legal name of this customer as authorized to do business in Texas. Include any abbreviations (LLC, Inc., etc.).

Mailing Address

Enter a central and general mailing address for this customer to receive mail from the TCEQ. For example, if this customer is a large company, this address might be the corporate or regional headquarters. On the other hand, for a smaller business, this address could be the same as the site address.

If this is a street address, please follow US Postal Service standards. In brief, these standards require this information in this order:

- the "house" number—for example, the 1401 in 1401 Main St
- if there is a direction before the street name, the one- or two-letter abbreviation of that direction (N, S, E, W, NE, SE, SW, or NW)
- the street name (if a numbered street, do not spell out the number—for example, 6th St, not Sixth St)
- an appropriate abbreviation of the type of street—for example, St, Ave, Blvd, Fwy, Exwy, Hwy, Cr, Ct, Ln
- if there is a direction after the street name, the one- or two-letter abbreviation of that direction (N, S, E, W, NE, SE, SW, or NW)
- if there is a room number, suite number, or company mail code

City, State, and ZIP Code

Enter the name of the city, the two-letter USPS abbreviation for the state (for example, TX), and the ZIP Code. (Enter the full ZIP+4 if you know it.)

Country Mailing Information

If this address is **outside** the United States, enter the territory name, country code, and any non-ZIP mailing codes or other non-U.S. Postal Service features here. If this address is **inside** the United States, leave these spaces blank.

Phone Number and Extension

This number should correspond to this customer's mailing address given earlier. Enter the area code and phone number here. Leave "Extension" blank if this customer's phone system lacks this feature.

Fax Number

This number should correspond to this customer's mailing address given earlier. Enter the area code and fax number here.

E-mail Address

As with the mailing address, this should be a general address that is appropriate for e-mail to this customer's central or regional headquarters, if applicable.

If "No Change" was checked for this customer, you may skip the rest of the fields in this part of the form and continue to the next part of the NOI.

Type of Operator

Check **only one** box.

Check ...	if this customer...
Individual	is a person and has not established a business to do whatever causes them to be regulated by us.
Sole Proprietorship—D.B.A.	is a business that is owned by only one person and has not been incorporated. This business may: <ul style="list-style-type: none">• be under the person's name• have its own name ("doing business as," or d.b.a.)• have any number of employees
Partnership	is a business that is established as a partnership as defined by the Texas Secretary of State's Office.
Corporation	meets all of these conditions: <ul style="list-style-type: none">• is a legally incorporated entity under the laws of any state or country• is recognized as a corporation by the Texas Secretary of State• has proper operating authority to operate in Texas.
Federal, state, county, or city government (as appropriate)	is either an agency of one of these levels of government or the governmental body itself (If a utility district, water district, tribal government, college district, council of governments, or river authority, check "Other" and write in the specific type of government.)
Other	fits none of the above descriptions. Enter a short description of the type of customer in the blank provided.

Independent Operator?

Check "No" if this customer is a subsidiary or part of a larger company. Otherwise, check "Yes."

Number of Employees

Check one box to show the number of employees for this customer's entire company, at all locations. **This is not necessarily the number of employees at the site named in this NOI.**

Federal Tax ID

All businesses, except for some small sole proprietors, should have a federal taxpayer identification number (TIN). Enter this number here. Use no prefixes, dashes, or hyphens. Individuals and sole proprietors do not need to provide a federal tax ID.

State Franchise Tax ID

Corporations and limited liability companies that operate in Texas are issued a franchise tax identification number. If this customer is a corporation or limited liability company, enter this number here.

DUNS Number

Most businesses have a DUNS (Data Universal Numbering System) number issued by Dun and Bradstreet Corp. If this customer has one, enter it here.

B. Billing Address

We will mail the annual fee invoice for this site to the address entered in this section.

Name

Enter the legal name of the person or business to which we should mail this site's fee invoice each year.

Mailing Address

Enter the specific mailing address to which we should mail this site's fee invoice each year. If this is a street address, please follow the US Postal Service standards as described under "A. Construction Site Operator Information" on page 1 of these instructions.

City, State, and ZIP Code

Enter the name of the city, the two-letter USPS abbreviation for the state (for example, TX), and the ZIP Code. (Enter the full ZIP+4 if you know it.)

Country Mailing Information

If this address is **outside** the United States, enter the territory name, country code, and any non-ZIP mailing codes or other non-U.S. Postal

Service features here. If this address is *inside* the United States, leave these spaces blank.

C. Project / Site Information

Check boxes and Regulated Entity Reference Number

These boxes designate this site's status as a TCEQ "regulated entity"—in other words, a location where an activity that we regulate occurs. We assign each regulated entity a number that begins with "RN," followed by nine digits. ***This is not a permit number, registration number, or license number.***

- If this site has not been assigned a Regulated Entity Reference Number or if this number is unknown, check "New" and leave the space for the Regulated Entity Reference Number blank.
- If this site has already been assigned this number, enter the Regulated Entity Reference Number and:
 - Check "No Change" if all the remaining information is the same as previously reported. However, even if there has been no change, you must complete this section at least through "E-mail Address" for this NOI to be valid.
 - If this site's information has changed since the last time it was reported to the TCEQ, check neither box and complete the remainder of this notice of intent.
- ***Do not enter a permit number, registration number, or license number in place of the Regulated Entity Reference Number.***

Name

Enter the name by which you want this site to be known to the TCEQ.

Mailing Address

Enter the specific mailing address for this site. If this is a street address, please follow the US Postal Service standards as described under "A. Construction Site Operator Information" on page 1 of these instructions. If the project / site's mailing address is the same as what is provided in Section A, you may enter "Same as Section A".

City, State, and ZIP Code

Enter the name of the city, the two-letter USPS abbreviation for the state (for example, TX), and the ZIP Code. (Enter the full ZIP+4 if you know it.)

Physical Address

Enter the physical address of the site itself. TCEQ staff should be able to use this address to find the site. Please follow the US Postal Service standards as described under "A. Construction Site Operator Information" on page 1 of these instructions. If the project / site does not have a physical address, enter "No Address".

City, County, and ZIP Code

Enter the name of the city, the county, and the ZIP Code. (Enter the full ZIP+4 if you know it.) This information must be provided even if you have entered "No Address" in the previous field.

Location Access Description

Enter a physical description of the location of the site based on highway intersections and/or permanent landmarks.

Latitude and Longitude

Enter the latitude and longitude of the site in *either* degrees, minutes, and seconds *or* decimal form.

For help obtaining the latitude and longitude, go to:

<http://www.tnrcc.state.tx.us/gis/drgview.html>

Standard Industrial Classification (SIC) Code and Activity Description

Provide the SIC code that best describes the construction activity being conducted at the site.

For help with SIC codes, go to:

<http://www.osha.gov/oshstats/sicser.html>

In addition to the SIC code, you must also provide a description of the construction activity being conducted at the site. This may include such descriptions as: "Apartment Building Construction" or "Shopping Center Construction."

Storm Water Pollution Prevention Plan

This plan identifies the areas and activities that could produce contaminated runoff at your site and then tells how you will ensure that this contamination is mitigated. For example, in describing your mitigation measures, your site's plan might identify the devices that collect and filter storm water, tell how those devices are to be maintained, and tell how frequently that maintenance is to be carried out. ***You must develop this plan before you complete this NOI.*** This plan must be available for a TCEQ investigator to review on request. Specific requirements for the development of the plan

can be found in the *Texas Pollutant Discharge Elimination System Construction General Permit (TXR150000)*.

Estimated Area of Land Disturbed

Provide the approximate number of acres that the construction site will disturb. It is appropriate to enter a value less than 5, only if the project is part of a larger common plan that disturbs five or more acres. If the acreage is less than 1, enter 1. "Disturb" means any clearing, grading, excavating, or other similar activities.

Is the site located on Indian Country Lands?

Check "Yes" only if the site is on a reservation or other areas designated by the federal government as Indian Country Lands. If not, check "No."

Destination of Storm Water Discharge

The storm water from your site eventually reaches a receiving water body such as a local stream or lake, possibly via a drainage ditch. The discharge may initially be into a municipal separate storm sewer system (MS4). Check the appropriate boxes for whether storm water is discharged into an MS4. If you checked "Yes" to "An MS4?", then enter the name of the entity that operates the storm sewer—often a city, town, or utility district, but possibly another form of government.

You must also provide the name of the water body that receives the discharge from the construction site (a local stream or lake). Storm water may be discharged directly to a receiving stream or via a storm sewer system. If known, please include the segment number if the discharge is to a classified water body.

For a map that includes segment numbers, go to:

<http://www.tnrcc.state.tx.us/water/quality/data/index.html>

D. Contact

Give all the relevant information for the person whom TCEQ can contact if there are questions about any of the information on this form—perhaps the same person who completed the form.

E. Payment Information

Provide the number and account holder name from the check or money order used to pay the \$100 application fee.

F. Certification

The operator must sign and date this statement to validate this NOI. Be sure to enter the full legal name of the person signing the form and the relevant title—for example, "Operator," "Vice-President," or "Partner." Use the "Prefix" blank for such titles as Dr., Mr., or Ms., as desired. Use the "Suffix" blank for such designations as Ph.D., Jr., Sr., III, or J.D., if applicable.

For a corporation, the application shall be signed by a responsible corporate officer. A responsible corporate officer means a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. Corporate procedures governing authority to sign permit applications may provide for assignment or delegation to applicable corporate positions rather than to specific individuals.

For a partnership or sole proprietorship, the application shall be signed by a general partner or the proprietor, respectively.

For a municipality, state, federal, or other public agency, the application shall be signed by either a principal executive officer or a ranking elected official. For purposes of this application, a principal executive officer of a federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g. regional administrator of the United States Environmental Protection Agency).

Questions?

If you have questions about any of the information on this form, contact our Storm Water Program at 512/239-4671 or look for "Storm Water" on our Web site:

www.tceq.state.tx.us



Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR150000)

For help completing this application, read the TXR150000 NOI Instructions
([TCEQ-20022-Instructions](#)).

TCEQ Office Use Only

TPDES Permit Number: TXR15* * * * * - NO

GIN Number: * * * * *

A. Construction Site Operator		New	No Change	Customer Reference Number: CN				
Name:								
Mailing Address:				City:		State:		Zip Code:
Country Mailing Information (if outside USA) Territory:				Country Code:		Postal Code:		
Phone Number:			Extension:		Fax Number:			
E-mail Address:								
Type of Operator:	Individual	Sole Proprietorship - D.B.A.	Partnership	Corporation	Federal Government			
	State Government	County Government	City Government	Other:				
Independent Operator?	Yes	No	Number of Employees:	0-20	21-100	101-250	251-500	501 or higher
Federal Tax ID:		State Franchise Tax ID Number:			DUNS Number:			

B. Billing Address			
Name:			
Mailing Address:		City:	State: Zip Code:
Country Mailing Information (if outside USA) Territory:		Country Code:	Postal Code:

C. Project / Site Information		New	No Change	Regulated Entity Reference Number: RN				
Name:								
Mailing Address:				City:		State:		Zip Code:
Physical Address:				City:		County:		Zip Code:
Location Access Description:								
Latitude:	°	'	" N	Longitude:	°	'	" W	Degrees (°), Minutes ('), and Seconds (")
Latitude:				Longitude: -				Decimal Form
Standard Industrial Classification (SIC) code:				Also, describe the construction activity at this site (<i>do not repeat the SIC code</i>):				
Has a storm water pollution prevention plan been prepared as specified in the general permit (TXR150000)? Yes No								
Estimated area of land disturbed (to the nearest acre):				Is the project / site located on Indian Country Lands? Yes No				
Does this project / site discharge storm water into a municipal separate storm sewer system (MS4)? Yes No								
If yes, provide the name of the MS4 operator:								
Provide the name or segment number of the water body that receives storm water from this project / site:								

D. Contact - If the TCEQ needs additional information regarding this application, who should be contacted?			
Name:		Title:	
Phone Number:		Extension:	
E-mail Address:		Fax Number:	

E. Payment Information - Check / Money Order Number:	Name on Check / Money Order:
-------------------------------------------------------------	------------------------------

F. Certification			
I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.			
Construction Site Operator:			
Prefix:	First:	Middle:	
Last:	Suffix:	Title:	
Signature: _____		Date: _____	

If you have questions on how to fill out this form or about the storm water program, please contact us at (512) 239-4671.
Individuals are entitled to request and review their personal information that the agency gathers on its forms. They may also have any errors in their information corrected. To review such information, contact us at (512) 239-3282.

The completed NOI must be mailed to the following address. Use the attached document to submit the \$100 application fee. Please note that the NOI and application fee are submitted separately to different addresses.

Texas Commission on Environmental Quality
Storm Water & General Permits Team; MC - 228
P.O. Box 13087
Austin, Texas 78711-3087

**Texas Commission on Environmental Quality
Payment Submittal Form**

The storm water application fee shall be sent under separate cover to the Texas Commission on Environmental Quality.

This form must be used to submit your Storm Water Application Fee. Please complete the following information, staple your check in the space provided at the bottom of this document, and mail it to:

BY REGULAR U.S. MAIL

Texas Commission on Environmental Quality
Financial Administration Division
Cashier's Office, MC-214
P.O. Box 13088
Austin, TX 78711-3088

BY OVERNIGHT/EXPRESS MAIL

Texas Commission on Environmental Quality
Financial Administration Division
Cashier's Office, MC-214
12100 Park 35 Circle
Austin, TX 78753

Fee Code: GPA

Storm Water General Permit: TXR150000

Check / Money Order No:

Amount of Check/Money Order:

Date of Check or Money Order:

Name on Check or Money Order:

Facility / Site Name:

Facility / Site Physical Address:

City:

Zip Code:

Staple Check In This Space

Completing the Notice of Termination for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR150000)

Who May File a Notice of Termination (NOT) Form

Permittees disturbing 5 acres or more (or part of a larger common plan of development or sale disturbing 5 acres or more) who are presently covered under the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit must submit a Notice of Termination (NOT) when final stabilization has been achieved on all portions of the site that is the responsibility of the permittee; or another permitted operator has assumed control over all areas of the site that have not been finally stabilized and all silt fences and other temporary erosion controls have either been removed, scheduled for removal as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage. Erosion controls that are designed to remain in place for an indefinite period, such as mulches and fiber mats, are not required to be removed or scheduled for removal.

Final Stabilization occurs when either of the following conditions are met:

- (a) All soil disturbing activities at the site have been completed and a uniform (e.g. evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.
- (b) For individual lots in a residential construction site by either:
 - (1) the homebuilder completing final stabilization as specified in condition (a) above; or
 - (2) the homebuilder establishing temporary stabilization for an individual lot prior to the time of transfer of the ownership of the home to the buyer and after informing the homeowner of the need for, and benefits of, final stabilization.
- (c) For construction activities on land used for agricultural purposes (e.g. pipelines across crop or range land), final stabilization may be accomplished by returning the disturbed land to its preconstruction agricultural use. Areas disturbed that were not previously used for agricultural activities, such as buffer strips immediately adjacent to a surface water and areas which are not being returned to their preconstruction agricultural use must meet the final stabilization conditions of condition (a) above.

A. TPDES Permit Number

Provide the TPDES permit number assigned to the operator of the construction site.

B. Construction Site Operator Information

Customer Reference Number

This number designates the operator's status as a TCEQ "customer"—in other words, an individual or business that is involved in an activity that we regulate. We assign each customer a number that begins with "CN," followed by nine digits. ***This is not a permit number, registration number, or license number.*** In the remainder of this section, we will use "this customer" to mean the operator for Part B of the form.

- If this customer has not been assigned a Customer Reference Number, leave the space for the Customer Reference Number blank.
- If this customer has already been assigned this number, enter the operator's Customer Reference Number.
- ***Do not enter a permit number, registration number, or license number in place of the Customer Reference Number.***

Name

Enter the legal name of this customer as authorized to do business in Texas. Include any abbreviations (LLC, Inc., etc.).

Mailing Address

Enter a central and general mailing address for this customer to receive mail from the TCEQ. For example, if this customer is a large company, this address might be the corporate or regional headquarters. On the other hand, for a smaller business, this address could be the same as the site address.

If this is a street address, please follow US Postal Service standards. In brief, these standards require this information in this order:

- the "house" number—for example, the 1401 in 1401 Main St
- if there is a direction before the street name, the one- or two-letter abbreviation of that direction (N, S, E, W, NE, SE, SW, or NW)
- the street name (if a numbered street, do not spell out the number—for example, 6th St, not Sixth St)
- an appropriate abbreviation of the type of street—for example, St, Ave, Blvd, Fwy, Exwy, Hwy, Cr, Ct, Ln
- if there is a direction after the street name, the one- or two-letter abbreviation of that direction (N, S, E, W, NE, SE, SW, or NW)
- if there is a room number, suite number, or company mail code

City, State, and ZIP Code

Enter the name of the city, the two-letter USPS abbreviation for the state (for example, TX), and the ZIP Code. (Enter the full ZIP+4 if you know it.)

Country Mailing Information

If this address is **outside** the United States, enter the territory name, country code, and any non-ZIP mailing codes or other non-U.S. Postal Service features here. If this address is **inside** the United States, leave these spaces blank.

Phone Number and Extension

This number should correspond to this customer's mailing address given earlier. Enter the area code and phone number here. Leave "Extension" blank if this customer's phone system lacks this feature.

Fax Number

This number should correspond to this customer's mailing address given earlier. Enter the area code and fax number here.

E-mail Address

As with the mailing address, this should be a general address that is appropriate for e-mail to this customer's central or regional headquarters, if applicable.

C. Project / Site Information

Regulated Entity Reference Number

This number designates this site's status as a TCEQ "regulated entity"—in other words, a location where an activity that we regulate occurs. We assign each regulated entity a number that begins with "RN," followed by nine digits. ***This is not a permit number, registration number, or license number.***

- If this site has not been assigned a Regulated Entity Reference Number, leave the space for the Regulated Entity Reference Number blank.
- If this site has already been assigned this number, enter the Regulated Entity Reference Number.
- ***Do not enter a permit number, registration number, or license number in place of the Regulated Entity Reference Number.***

Name

Enter the name by which you want this site to be known to the TCEQ.

Physical Address

Enter the physical address of the site itself. TCEQ staff should be able to use this address to find the site.

Location Description

Enter a physical description of the location of the site based on highway intersections and/or permanent landmarks.

City, County, and ZIP Code

Enter the name of the city, the county, and the ZIP Code. (Enter the full ZIP+4 if you know it.)

D. Contact

Give all the relevant information for the person whom TCEQ can contact if there are questions about any of the information on this form—perhaps the same person who completed the form.

E. Certification

The operator must sign and date this statement to validate this NOI. Be sure to enter the full legal name of the person signing the form and the relevant title—for example, "Operator," "Operator's attorney," or "Senior Site Manager." Use the "Prefix" blank for such titles as Dr., Mr., or Ms., as desired. Use the "Suffix" blank for such designations as Ph.D., Jr., Sr., III, or J.D., if applicable.

For a corporation, the application shall be signed by a responsible corporate officer. A responsible corporate officer means a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. Corporate procedures governing authority to sign permit applications may provide for assignment or delegation to applicable corporate positions rather than to specific individuals.

For a partnership or sole proprietorship, the application shall be signed by a general partner or the proprietor, respectively.

For a municipality, state, federal, or other public agency, the application shall be signed by either a principal executive officer or a ranking elected official. For purposes of this application, a principal executive officer of a federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g. regional administrator of the United States Environmental Protection Agency).

Questions?

If you have questions about any of the information on this form, contact our Storm Water Program at 512/239-4671 or look for "Storm Water" on our Web site:

www.tceq.state.tx.us

SECTION 01450

CHEMICAL DATA QUALITY CONTROL

PART 1 GENERAL

This section is to be used with Section 02115 - Hydrant Fueling System Removal.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 268	Land Disposal Restrictions
49 CFR 172	Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packaging

U.S. ARMY CORPS OF ENGINEER MANUAL (EM)

EM 200-1-1	(1994) Validation of Analytical Chemistry Laboratories
EM 200-1-3	(1994) Requirements for the Preparation of Sampling and Analysis Plans Ch 1
EM 200-1-6	(1997) Chemical Quality Assurance

U.S. ARMY CORPS OF ENGINEERS ENGINEER MANUAL (ER)

ER 1110-1-263	(1996) Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities
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ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 540/R 94-012	(1994) Contract Laboratory Program National Functional Guidelines for Inorganic Data Review
EPA 540/R 94-013	(1994) Contract Laboratory Program National Functional Guidelines for Organic Data Review

EPA SW-846

(Rev O; updates I, II, IIA, IIB, and III)
Test Methods for Evaluating Solid Waste
(Vol IA, IB, IC, and II)

1.2 ACRONYMS

The definition of acronyms used by the Contractor that pertain to chemical data quality control shall be clearly defined for all contract related products and communications.

1.3 MEASUREMENT AND PAYMENT

Separate payment will not be made for providing and maintaining the chemical data quality requirements including the chemical data quality management, chemical data validation, minimum chemical data reporting requirements, and chemical data quality submittal requirements; these costs shall be included in the applicable unit prices or lump sum prices contained in the bidding schedule.

1.4 CHEMISTRY REQUIREMENTS

Chemical Data Quality Control (CDQC) shall be as defined in ER 1110-1-263; this ER, which integrates USACE guidance on the subject, shall be supplemented by EM 200-1-6 for detail technical guidance on CDQC. Tables and charts defining Design Analysis (DA), ROD, and remedial technology specific chemistry shall be according to or consistent with EM 200-1-3.

1.4.1 Site History

Reference Section 02115 - Hydrant Fueling System Removal for site history.

1.4.2 Data Quality Objectives (DQO)

Sample acquisition, chemical analysis and chemical parameter measurements shall be performed so that the resulting data meet and support data use requirements. The chemical data shall be acquired, documented, verified and reported to ensure that the specified precision, accuracy, representativeness, comparability, completeness and sensitivity requirements are achieved.

1.4.3 Sampling, Analysis and Measurement

1.4.3.1 Soil/Sediment and Water Samples

Soil/sediment and water samples shall be collected and analyzed in accordance with the approved Sampling and Analysis Plan.

1.4.3.2 Not Used

1.4.3.3 Not Used

1.4.3.4 Not Used

1.4.3.5 Manifesting Samples

If manifesting samples are required for work in Section 02115 - HYDRANT FUELING SYSTEM REMOVAL,

material shipping manifesting shall be in accordance with 40 CFR 261, 40 CFR 262, 40 CFR 268, 49 CFR 172, and 49 CFR 178.

1.4.3.6 Not Used

1.4.3.7 Real-Time Instrumental Measurement Samples

Real-time instrumental measurements shall be analyzed onsite for chemical parameters.

1.4.3.8 Perimeter Air Monitoring Samples

Perimeter air monitoring samples shall be analyzed.

1.4.3.9 Compatibility Field Testing for Bulking Operations

The Contractor shall use appropriate compatibility field tests before any bulking operations. The compatibility testing system shall include procedures for: 1) sample acquisition; 2) compatibility tests on collected samples; 3) sample compositing; 4) bulking; and 5) limitations.

1.4.3.10 Not Used

1.4.3.11 Field Screening

Field screening shall include photoionization detector and/or flame ionization detector, immunoassay field kits or similar methods.

1.5 QUALITY ASSURANCE ELEMENTS

The Contractor shall be responsible for the following QA elements necessary to monitor and ensure the quality of chemical data produced.

1.5.1 Laboratory Validation Requirements

The Contractor shall propose the minimum number of laboratories that can attain or have attained U.S. Army Corps of Engineers (USACE) validation in accordance with EM 200-1-1 and consistent with contract required chemical data quality. The Contractor may propose laboratories that shall subsequently be validated by the USACE, or select currently validated USACE laboratories. The Contractor shall identify all proposed project laboratories (field/QC lab and QA lab) in the sampling and analysis plan (SAP). If a proposed analytical laboratory cannot meet specified analytical requirements or achieve the required validation, the Contractor shall select another laboratory. If not currently validated, the USACE laboratory validation process requires a nominal 120 day process. A current list of validated laboratories is available, by contacting the Corps of Engineers in Environmental Design Branch at 817/978-3122, EXT. 1639

1.5.2 Quality Assurance Sample Collection and Analysis

The Contractor shall be responsible for collection and transportation of QA samples to the QA laboratory. Samples for all analyses (except volatiles) shall be taken as splits of homogenized samples. Samples for volatiles shall be collected as discrete duplicates/triplicates. Triplicate (field, QC and QA) samples shall be collected at a rate of 10 percent per matrix per analysis per sampling event. The rinsate samples shall be taken at 20 percent frequency from non-dedicated equipment following purging.

- a. The Contractor shall submit the QA Laboratory Advance Notification (QALAN) to the QA laboratory. The QALAN shall include a list of laboratory-related DQO. The DQO shall include, but shall not be limited to, identification of extraction and analysis method numbers, a list of analytes with required limits, estimated number of tests, approximate sampling dates, and requested completion date for QA testing. The Contractor shall notify the COR and the QA laboratory immediately of any changes.
- b. The Contractor shall provide all labor and field supplies, including sample containers and shipping coolers, for collecting and shipping samples for QA testing. The Contractor shall, notify the Contracting Officer Representative (COR), when properly collect, label, and package the QA samples, fill out all chain-of-custody forms, and ship the samples by one-day delivery service to the designated QA laboratory for analysis. The Contractor shall notify the laboratory when all sampling is completed and shall clearly mark the chain-of-custody form accompanying the final shipment "FINAL" in 1 inch high lettering.
- c. The Contractor shall allow 60 calendar days for laboratory analysis of QA samples, data review, and submission of the chemical quality assurance report. The elapsed time shall begin when the Contractor's last sample arrives at the QA laboratory, provided that the Contractor's completed chemistry data package is received within 30 calendar days thereafter. Otherwise, the Contractor shall allow 30 calendar days from the date the completed chemistry data package is received at the laboratory. The Contractor may, as an option, continue activities based on initial field sampling and QC results, before receipt of QA test results. Where QA results are unacceptable due to Contractor negligence (e.g. improper sample collection and/or handling by the Contractor), or where QA sample results conflict with the Contractor's primary field sample results, further sampling and testing shall be performed as directed by the COR. All costs for such additional sampling and testing due to Contractor negligence, including field, QC and QA testing and analysis, and for any required remedial actions in the work, shall be borne by the Contractor. USACE acceptance of final disposition of any excavated soil (if contaminated soil present in this contract) shall not occur until the Contractor's sampling and QC results have been confirmed by QA results. No payment will be made for laboratory sampling and testing before receipt and acceptance by the Government of the QA samples and the completed Chemical Data Final Report (CDFR), properly formulated according to these specifications.

1.5.3 Not Used

1.5.4 Review of Primary Laboratory Data

The Contractor shall be responsible for the independent data review of the entire primary data set.

1.5.5 Validation of Data

The Contractor shall be responsible for validating 100 percent of the data in accordance with EPA 540/R 94-012 and EPA 540/R 94-013. The data validation strategy shall be established at the beginning of the project to

be consistent with project DQO.

1.5.6 Electronic Tape Audits

The Contractor shall perform an electronic tape audit on 10 percent of project sample results. The raw data from a given batch shall be re-calculated and compared to the results reported by the laboratory. The data quality shall be measured by laboratory compliance with the required methods and acceptable practices for analysis and data reduction.

1.6 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Sampling and Analysis Plan; GA.

The SAP including the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP), no later than 20 calendar days after receipt of notice to proceed.

SD-09 Reports

Quality Assurance Sample Collection and Analysis; FIO.

The QA Laboratory Advance Notification (QALAN); it shall be provided to the QA laboratory at least 10 business days before the initial shipment of samples.

Chemistry Data Package; FIO.

The chemistry data package; it shall be provided to the QA lab as an attachment to the CDFR as soon as available during execution of work for specification Section 02115 HYDRANT FUELING SYSTEM REMOVAL.

Chemical Data Final Report; GA.

The CDFR shall be submitted before final payment. Each report shall be labeled with the contract number, project name and location.

1.7 QUALIFICATIONS

1.7.1 Chemical Quality Control Officer

As a minimum, the Contractor's Chemical Quality Control Officer shall have:
a B.S. degree in Chemistry; a minimum of 2 years of experience related to investigations, studies, design and remedial actions at HTRW sites; and 5 field seasons (or one continuous calendar year experience) in calibration and operation of various field monitoring devices as well as standard analytical chemistry methods common for analyzing soil, water, air and other materials for chemical contamination assessment, including hazardous waste manifesting. The Chemical Quality Control Officer shall ensure that all chemistry related objectives including responsibilities for DQO definitions, sampling and analysis, project requirements for data documentation and validation, and final project reports are attained. The

Chemical Quality Control officer need not be present on site during routine sampling, but shall be available for consultation with Government and Contractor personnel.

1.7.2 Project Chemist

As a minimum, the Contractor's Senior Chemist shall have: a B.S. degree in Chemistry; 2 years of experience related to investigations, studies, design and remedial actions at HTRW sites; 5 field seasons experience in calibrating and operating various field monitoring devices; and 2 years of experience in the operation of an HTRW commercial laboratory with standard analytical chemistry methods common for analyzing soil, water, air and other materials for chemical contamination assessment, including data for hazardous waste manifesting. The project chemist shall ensure that all chemistry related goals of the program are attained. The project chemist shall be on-site during all sampling events and shall also be available for consultation with Government personnel.

1.7.3 Environmental Sampler

As a minimum, the Contractor's Environmental Sampler shall have: a B.S. degree in Chemistry, Environmental Science, Engineering, Geology, Hydrology, or a related field; 2 years of experience in the development and preparation of SAP and work plans; 2 years of experience in and knowledge of EPA methods for collecting environmental and hazardous waste samples; 2 years of experience in operation of field screening equipment (e.g. PID, FID, infrared spectrometer, immunoassay, etc.); and 5 field seasons of experience with the particular field screening techniques for use on this project. The Environmental Sampler shall collect all on site samples and perform all field screening tests. The Environmental Sampler shall review the sampling results, and provide recommendations for the Contractor's sampling program. The Environmental Sampler shall be on site during all excavation and stockpiling operations involving contaminated soil or soil to be checked for contamination.

1.8 COORDINATION MEETING

After the preconstruction conference, before any sampling or testing, the Contractor shall coordinate with the Contracting Officer to meet and discuss the CQC Plan and the SAP. The coordination meeting will be simultaneous to any CQC coordination meeting required in Section 01451 CONTRACTOR QUALITY CONTROL unless otherwise indicated or directed. A list of definable features that involve chemical measurements shall be agreed upon. At a minimum, each matrix (soil, water, air, containerized wastes, radioactive wastes, instrumental chemical parameter measurement, etc.) shall be a definable work feature. Management of the chemical data quality system including project DQO, project submittals, chemical data documentation, chemical data assessment, required sampling and analysis protocols, and minimum data reporting requirements shall be agreed upon. The meeting will serve to establish an interrelationship between the Contractor's chemical data quality management and Government chemical quality assurance requirements. Minutes of the meeting will be documented by the Government and shall be signed by both the Contractor and the Contracting Officer. The minutes will include any or all unresolved chemical issues along with the conditions for resolution and will become a part of the contract file.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor shall be responsible for chemical sample acquisition, sample analysis, instrumental measurements of chemical parameters and for chemical data quality control. An effective chemical data quality control system shall be established that meets the requirements for the chemical measurement DQO applicable to the project. The system shall cover chemical measurements pertaining to and required for Contractor and subcontractor produced chemical data. The Contractor shall control field screening, sampling, and testing in conjunction with activities described in Section 02115 to meet all DQO; minimize the amount of excavated material requiring temporary storage; prevent dilution of contaminated soils (if present) with clean soils; and ensure completion of work within the required time.

3.2 QUALITY CONTROL PLAN

3.2.1 General

In addition to the quality control requirements specified in Section 01451 CONTRACTOR QUALITY CONTROL, the CQC Plan shall incorporate the qualifications, authority and responsibilities of all chemical quality management and support personnel. Chemical measurements including sampling and/or chemical parameter measurement will not be permitted to begin until after production and acceptance of the CQC Plan, and Government approval of the SAP.

3.2.2 Chemistry Elements of the CQC Plan

To cover contract related chemical measurements by the Contractor and all subcontractors, the CQC Plan shall include the following as a minimum.

3.2.2.1 Qualifications

Names, education, experience qualifications, authorities, and decision-making responsibilities of all chemical quality management and support personnel. The CQC Plan shall contain a copy of a letter from the project QC manager designating and authorizing a Chemical Quality Control Officer and chemical quality control organization staff.

3.2.2.2 Authority and Responsibility

A diagram, flow chart, or figure clearly depicting the chemical data quality management and support staff and the authority and responsibility of each for chemical sampling and analysis, procedures for corrective actions, deliverables and submittals, deviations and changes, chemical quality documentation, data validation, minimum data reporting requirements, and DQO for chemical parameter measurement by the Contractor and subcontractors. The contents of this section of the CQC Plan shall be included in the applicable "Project Organization" elements of the FSP and the QAPP.

3.3 SAMPLING AND ANALYSIS PLAN

The SAP shall be prepared in accordance with CDQC requirements and EM 200-1-3. The SAP shall be a two-part document that contains two distinct elements: FSP and QAPP. Sections of the FSP and QAPP shall be cross referenced. The SAP shall confirm the Contractor's understanding of the

contract requirements for chemical data quality control, and shall describe procedures for field sampling and sample submittal for analysis, field chemical parameter measurement, data documentation, data assessment and data reporting requirements. The SAP shall delineate the methods the Contractor intends to use to accomplish the chemical quality control items to assure accurate, precise, representative, complete, legally defensible and comparable data. The SAP shall describe all chemical parameter measurements for all matrices. As a single interrelated document, the SAP shall be provided to field and laboratory personnel. The Contractor may propose original/innovative approaches to chemical parameter measurements for cost reduction and remediation (in case of soil contamination) efficiency by abbreviated sampling, contingency sampling and/or contingency analysis, indicator or tracer analysis, onsite analytical services, equivalency or screening methods. The SAP shall clearly identify the Contractor obtained laboratories. The Contractor shall furnish copies of the Government approved SAP to all laboratories and the Contractor's field sampling crew. The SAP shall address all levels of the investigation with enough detail to become a document which may be used as an audit guide for field and laboratory work.

3.3.1 Field Sampling Plan

The FSP shall contain necessary technical detail and direction for the field personnel to understand sampling and field measurement requirements. The FSP shall provide a comprehensive description and full detail for personnel to perform all onsite activities required to attain project DQO, including: locations of samples, sampling procedures for onsite and offsite chemical analysis, summaries of analyses to be performed on samples, shipment of samples for offsite analyses, performance of onsite and offsite instrumental parameter measurements, data documentation and reporting requirements.

3.3.2 Quality Assurance Project Plan

The QAPP shall contain necessary technical detail and direction for field and laboratory personnel to understand project sample analysis, quality control and data reporting requirements, analytical methods, required detection limits, QC requirements, QA and data validation and reporting requirements.

3.4 CHEMISTRY DATA PACKAGE

The chemistry data package, from the Contractor, shall be provided through USACE COR to the QA lab, and is an attachment to the CDFR. The chemistry data package shall contain information to demonstrate that the project's DQO have been fulfilled. The QA function will compare QA sample results to corresponding primary sample results, will assess the Contractor's compliance with the SAP, and will recommend corrective action as necessary. The chemical data package shall include, as a minimum, but not limited to, original samples chain of custody, laboratory traffic reports, cooler receipt forms, associated QC parameters, such as method blank, MS, MSD, laboratory control spike (LCS), and laboratory control spike duplicate (LCSD) analytical results, initial calibration curves, and continuing verification standards to the COR.

3.5 CONTROL OF CHEMICAL DATA QUALITY

Contractor chemical data quality control shall ensure that a quality control program is in place that assures sampling and analytical activities

and the resulting chemical parameter measurement data comply with the DQO and the requirements of the SAP. The Contractor shall utilize the three-phase control system that includes a preparatory, initial and follow-up phase for each definable feature of work. The Contractor's three-phase chemical data control process shall ensure that data reporting requirements are achieved and shall be implemented according to Section 01451 CONTRACTOR QUALITY CONTROL. The three-phase chemical data control process shall be combined with that under Section 01451 CONTRACTOR QUALITY CONTROL.

3.6 ANALYTICAL TESTING LABORATORIES

The Contractor shall propose the analytical laboratories to be used for the primary samples analyses. Laboratory validation requirements shall be in accordance with paragraph LABORATORY VALIDATION REQUIREMENTS. The Contractor may utilize its own laboratory or utilize subcontract laboratories to achieve the primary required sample analyses.

3.6.1 Laboratory Analytical Requirements

The Contractor shall provide the specified chemical analyses by the Contractor's laboratory. The Contractor shall provide chemical analyses to achieve the project DQO for all parameters specified by the methods. To give the USACE programs the greatest flexibility in the execution of its projects, the EPA SW-846 methods are generally the methods employed for the analytical testing of environmental samples. These methods are flexible and shall be adapted to individual project-specific requirements. Texas Method 1005 is recommended for TPH under the TRRP (see specification Section 02115 -HYDRANT FUELING SYSTEM REMOVAL).

3.6.2 Laboratory Performance

The Contractor shall provide continued acceptable analytical performance and shall establish a procedure to address data deficiencies noted by review and/or quality assurance sample results. The Contractor shall provide and implement a mechanism for providing analytical labs with the SAP or QAPP portion of the SAP, for monitoring the lab's performance and for performing corrective action procedures. The Contractor shall acquire analytical services with additional USACE validated laboratories in the event a project lab loses its validation status during the project.

3.7 CHEMICAL DATA FINAL REPORT

The CDFR shall be produced including a summary of quality control practices employed and all chemical parameter measurement activities after project completion. As a minimum, the CDFR shall contain the following:

- a. Summary of project scope and description.
- b. Summary of any deviations from the design chemical parameter measurement specifications.
- c. Summary of chemical parameter measurements performed as contingent measurements.
- d. Summary discussion of resulting data including achieving data reporting requirements.
- e. Summary of achieving project specific DQO.

- f. Presentation and evaluation of the data to include an overall assessment on the quality of the data for each method and matrix.
- g. Internal QC data generated during the project, including tabular summaries correlating sample identifiers with all blank, matrix spikes, surrogates, duplicates, laboratory control samples, and batch identifiers.
- h. A list of the affected sample results for each analyte (indexed by method and matrix) including the appropriate data qualifier flag (J, B, R, etc.), where sample results are negatively impacted by adverse quality control criteria.
- i. Summary of field and laboratory oversight activities, providing a discussion of the reliability of the data, QC problems encountered, and a summary of the evaluation of data quality for each analysis and matrix as indicated by the laboratory QC data and any other relevant findings.
- j. Conclusions and recommendations.
- k. Appendices containing: (1) Chemistry data package, and (2) Results of the Chemical Quality Assurance Report Data Package (CQAR). The CQAR is a QA lab produced document, achieved through the inspection and analysis of QA samples and corresponding project sample data. The CQAR will include review of all QC parameters such as holding times, detection limits, method blanks, surrogate recoveries, matrix spikes and duplicates, and inter-laboratory and intra-laboratory data comparisons.

3.8 DOCUMENTATION

Documentation records shall be provided as factual evidence that required chemical data has been produced and chemical data quality has been achieved. The documentation shall comply with the requirements specified in paragraphs SAMPLING AND ANALYSIS PLAN, CHEMISTRY DATA PACKAGE, and CHEMICAL DATA FINAL REPORT.

3.9 NOTIFICATION OF NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice.

-- End of Section --

SECTION 02090

LEAD-BASED PAINT (LBP) ABATEMENT AND DISPOSAL
AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD-01	(1996) Lead-Based Paint: Guidelines for the Availability and Control of Lead-Based Paint Hazards in Housing
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ENGINEERING MANUALS (EM)

EM 385-1-1	(1992) U.S. Army Corps of Engineers Safety and Health Requirements Manual
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701

(1996) Methods of Fire Test for
Flame-Resistant Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH OSHA Booklet 3142

Lead in Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment List; GA.

A list of equipment items to be used in the work, including brand names, model, capacity, performance characteristics, quantities and other pertinent information.

SD-08 Statements

Lead-Based Paint (LBP) Inventory; GA.

A written inventory shall be prepared that identifies the LBP containing debris for disposal. The LBP schedule on environmental drawing will be the basis of the inventory. Areas and materials identified as containing LBP shall be managed per paragraph 1.4 DESCRIPTION OF WORK, in this section. If the Contractor's inventory identifies additional LBP containing items for disposal, the Contractor shall analyze these items for TCLP-lead and make an amendment to the inventory. Costs of sampling and analysis to verify or add to the Contractor's LBP Inventory shall be approved by the Contracting Officer in advance.

Lead-Based Paint (LBP) Management Plan; GA.

The Contractor shall prepare a detailed LBP Management Plan that identifies the work procedures, health, and safety measures to be used in LBP abatement. Two copies of this plan shall be submitted 20 days prior to the pre-construction conference. One of the is for Rosemarie Olney, Industrial Hygienist, Fort Hood-DPW. The plan shall address the various sources of lead and the methods to be undertaken to abate the lead hazards to include the following key elements:

- a. Description and location of LBP containing components keyed to project drawings.
- b. Abatement methods for each LBP containing component.
- c. Not Used.
- d. Training requirements as required by Federal, state, and local regulations.

- e. Unique problems associated with the LBP abatement project.
- f. Sketch of LBP control areas and decontamination areas.
- g. Eating, drinking, smoking, and rest room procedures.
- h. Sequencing of LBP related work.
- i. Personnel protective equipment; respiratory protection program and controls.
- j. Engineering controls, containment structures and safety measures.
- k. Worker exposure assessment procedures.
- l. Work Practice controls.
- m. Housekeeping.
- n. Hygiene facilities and practice.
- o. Medical surveillance, including medical removal protection.
- p. Sampling, testing and analytical methods to include personal air sampling requirements of 29 CFR 1926 Section .62 for work in this section. Personal sampling shall be in accordance with NIOSH pub. 84-100 Method 7082 for lead. When specified or where required, dust wipe sampling (pre-abatement, during abatement and post abatement), soil sampling (pre-abatement, during abatement, and post abatement), and toxicity characteristic leaching procedure (TCLP-lead, EPA Method 1311/6010) of the waste material in accordance with 40 CFR 261 shall be used. Analytical procedures must include frequency, locations, and sampling and analytical methods to be used.

Emergency Contingency Plan; GA

An emergency contingency plan shall be prepared in accordance with 40 CFR 261. Procedure must address the following LBP abatement hazards as appropriate to the project:

- a. Negative air pressure system failure.
- b. Major breach of containment barriers.
- c. Detection of unexpected lead levels on adjacent grounds.
- d. Spilling of lead debris bags or containers.
- e. Phone numbers for project manager, local fire, police and medical personnel.

Waste Management Plan, Waste Handling and Site Storage Plan; GA.

A Waste Management Plan shall be prepared that complies with applicable requirements of Federal, state, and local LBP waste regulations and addresses:

- a. Identification or documentation of potential LBP wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes; the facility location, phone number, and name of a 24-hour point of contact shall be included. If applicable, two copies of EPA, state, and local LBP waste permit applications, permits, and EPA identification numbers.
- d. Names and qualifications (experience and training) of personnel who will be working on-site with LBP waste.
- e. List of waste handling equipment to be used in performing the work to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and clean-up contingency measures to be implemented.
- g. Work plan and schedule for waste containment, removal, and disposal. Waste shall be cleaned up and containerized daily.
- h. Cost for LBP waste disposal according to this plan.

A Handling and Site Storage Plan shall be prepared that addresses the handling and storage of LBP debris in accordance with the requirement of 40 CFR 262 and 40 CFR 265. If manifesting is required, the Contractor shall confirm that an EPA identification number has been obtained so that proper manifesting of the waste will be addressed. The Contractor shall ensure site storage limitations, including the time of storage, container requirements, contingency plan, and personnel training have been complied with.

Waste Disposal Plan; GA.

A Waste Disposal Plan shall be prepared that will include but not be limited to the following:

- a. A written confirmation that the debris will be treated and disposed of in accordance with the requirements of 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 264 and 40 CFR 268.
- b. A written confirmation that transportation of the debris will be in accordance with 40 CFR 263.
- c. Waste subcontractor's name, address, telephone number, and landfill location, including copies of licenses and signed agreements.
- d. Landfill name, address, and telephone number. A copy of the landfill's state and locally issued license, and a signed agreement that the landfill will accept the LBP wastes.
- e. Detailed delivery tickets prepared, signed, and dated by an agent of the landfill, certifying the amount of LBP containing materials delivered to the landfill, within 3 days after delivery.

SD-09 Reports

Sampling Result and Final Disposition Report; GA.

A daily log of the personal, and if applicable, the environmental air sampling test results shall be reviewed by the Competent Person and submitted to the COR, in written form, no more than 48 hours after completion of the sampling cycle. The log shall list each sample result, sampling time and date, sample type, identification of personnel monitored, flow rate and duration, air volume sampled, yield of lead, cassette size, analytical method used, analyst's name and company, and interpretation of results. Results shall be reported in micrograms of lead per cubic meter (ug/m3) of air. Documentation of results that exceed specified limits (personal air samples that exceed 30 ug/m3 or as required by Federal, state or local requirements shall be highlighted in the log in such a manner to make them easily distinguishable from monitoring results that do not exceed specified or regulatory limits.

Final Disposition Report, including work performed and air monitoring results, in this section shall be provided prior to final payment. Separate copy of the daily air monitoring results and the Final Disposition Report shall be provided to the Environmental Management Office at DPW, Environmental Management Branch, B/4219, 77th St., Fort Hood, TX 76554-5028

SD-13 Certificates

Quality Assurance; GA.

Certificates shall meet the requirements of paragraph QUALITY ASSURANCE. The statements shall be signed and dated by a certifying officer after the award of this contract and contain the following:

- a. Contractor's name and address.
- b. Project name and location.
- c. The specified requirements that are being certified as stated in paragraph 1.3.1 Qualifications, subparts a through f.

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

- a. Contractor: Certification that the Contractor has prior experience on LBP abatement projects similar in nature and extent to ensure the capability to perform the abatement in a satisfactory manner.
- b. Competent Person: Certification that the Contractor's full-time on-site Competent Person meets the competent person requirements of 29 CFR 1926 Section .62 and is experienced in administration and supervision of LBP abatement projects, including work practices, protective measures for building and personnel, disposal procedures, etc. This person shall have completed a Contractor Supervisor LBP abatement course by an EPA Training Center or an equivalent certification course, and have had a minimum of 2 years on-the-job experience.
- c. Not Used.

- d. Industrial Hygienist: Certification that the Industrial Hygienist meets the Office of Personnel Management Standard for the Industrial Hygiene Series GS-690, and has a minimum of two years experience in LBP abatement.
- e. Testing Laboratory: The name, address, and telephone number of the independent testing laboratory selected to perform sampling and analysis for personal and environmental air samples, lead dust wipes, bulk sample analyses, and TCLP analysis. Documentation that the laboratory performing the analysis is an EPA National Lead Laboratory Accreditation Program (NLLAP) accredited laboratory and that it is rated proficient in the NIOSH/EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT). Certification shall include accreditation for heavy metal analysis, list of experience relevant to analysis of lead in air, and a Quality Assurance and Quality Control Program. Currently, the American Association for Laboratory Accreditation (ASLA) and the American Industrial Hygiene Association (AIHA) are the EPA recognized laboratory accreditors. Documentation shall include the date of accreditation or reaccreditation.
- f. Blood Lead Testing Laboratory. The name, address and telephone number of the blood lead testing laboratory; the laboratory's listing by OSHA and the U.S. Public Health Service Center for Disease Control (CDC); and documentation that the laboratory certified in the state where the work site is located.

1.3.2 Respiratory Protection Devices

Manufacturer's certification of NIOSH or the Mine Safety and Health Administration (MSHA) approval for respiratory protection devices utilized on the site.

1.3.3 Cartridges, Filters, and Vacuum Systems

Manufacturer's certification of NIOSH approval of respirator cartridges (organic vapor, acid gas, mist, dust, high efficiency particulate); High Efficiency Particulate Air (HEPA) filtration capabilities for all cartridges, filters, and HEPA vacuum systems.

1.3.4 Medical Records

Certification that employees who are involved in LBP abatement work have received medical examinations and will receive continued medical surveillance, including biological monitoring, as required by 29 CFR 1926 Section .62 and by the state and local regulations pertaining to such work. Records shall be retained, at Contractor expense, in accordance with 29 CFR 1910 Section .20.

1.3.5 Training

Training certification shall be provided prior to the start of work involving LBP abatement, for all of the Contractors' workers, supervisors and Competent Person. Training shall meet the requirements of 29 CFR 1926 Section .62, 29 CFR 1926 Section .59 and 49 CFR 172, and that required by EPA or the state LBP course for the work to be performed. Training shall be provided prior to the time of job assignment and, at least, annually. Training may cover all abatement methods or focus only on those methods

specified in the LBP Management Plan. The project specific training shall, as a minimum, include the following:

- a. Specific nature of the operation which could result in exposure to lead.
- b. Purpose, proper selection, fitting, use, and limitations of respirators.
- c. Purpose and description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant).
- d. Relevant engineering controls and good work practices.
- e. The contents of any compliance plan in effect.
- f. Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.
- g. The employee's right of access to records under 29 CFR 1910Section .20.

1.3.6 Licenses and Permits

Copies of licenses and permits as required by applicable Federal, state, and local regulations shall be obtained at least 20 working days before the start of the LBP abatement project. The Contractor shall prepare the necessary document and obtain signature from the DPW-Environmental personnel who has signature authority. The Contractor shall provide a copy of the signed document to the Contacting Officer annotated with the date of mailing to the regulatory agency.

1.4 DESCRIPTION OF WORK

Work in this section shall be performed at Fort Hood, Texas for the project Fixed Wing Aircraft Park. It includes Base Bid Work for [AM#2] abatement of lead-based paint [AM#2] on [AM#2] B90071 (vehicle scale), [AM#2] and in Building[AM#2]s [AM#2] _____; Building 90050 (Fire Station, 11646 SF); and Building 90049 (Control Tower and Ops Bldg., 23812 SF) [AM#2] as noted on demolition drawings and attached detailed report of lead paint inspection.

Lead-based Paint (LBP) Survey with x-ray fluorescent (XRF) analyzer was performed by COE for the above structures (reference [AM#1] _____ drawing [AM#1]s [AM#1] and attached detailed report of Lead Paint Inspection for physical locations of structures). XRF sample locations of painted surfaces are shown on the environmental drawings and XRF readings and TCLP-lead results are appended herein.

No lead based paint is detected in B/90079 and 90080, except in 90071. The demolition debris from 90079 and 90080 shall be disposed of as construction debris at the Fort Hood Landfill. However, LBP shall be abated (from airfield apron, hydrant fueling pits, and 90071) by removal of paint from the substrate [AM#2] shall be disposed of at a permitted treatment and disposal facility off post. The TCLP-lead result of yellow paint chips from concrete (of 90071), based on COE survey, has non-detected level of

leachable lead in (mg/l). The Contractor shall obtain a composite sample of debris to analyze for TCLP-lead analysis and verify disposal at Fort Hood Landfill. The Contractor shall salvage, to the maximum extent possible, bulk scrap metal and glass for recycling.

LBP abatement in B/90050, shall include (1) removal of wood components, with dark brown paint (soffit fascia board), light gray paint (from wall, post and doors, etc.), and concrete vehicle bumper with yellow paint, (2) removal of yellow safety striping paint (see [AM#1]_____ [AM#1]report). The XRF readings of the dark brown paint are 7.5 mg/sq. cm. The XRF readings of light gray paint are ranged from 1.5 to 6.2 mg/ sq. cm. The XRF readings of the yellow paint is 2.2 mg/ sq. cm. The TCLP-lead result of dark brown paint is 12.5 mg/l, and is hazardous. The Contractor shall segregate the dark brown wood components and disposed of as hazardous waste. A composite sample of the dark brown wood debris shall be obtained and analyzed for TCLP-lead prior to disposal at a permitted treatment and disposal facility off post. The Contractor shall prepare waste manifest and obtain signature from authorized personnel at the DPW-Environmental. No waste analysis for TCLP-lead was performed on the light gray wood component or the yellow paint in the COE survey. A composite sample of debris from the light gray wood component and yellow paint shall be obtained for TCLP-lead analysis by the Contractor to verify disposal at Fort Hood Landfill.

Soil sampling is required for B/90050, reference paragraph 3.4.5 Soil Sampling.

Post LBP abatement and recycling (of glass and metal) the whole structure (90050) shall be disposed of as construction debris. Since a weighted composite sample of building material simulating debris of B/90050 was obtained by COE at survey and the TCLP-lead result is 0.622 mg/l.

LBP abatement in B/90049, shall include component removal of (1) double wood door frame in basement, (2) wood door on the Control Tower 5th floor (see environmental drawings on sheet no. H-3). The wood door frame in basement hallway has total lead content of 2110 mg/kg (which is not classified as LBP) and no abatement is required. Post LBP abatement and recycling (of glass and metal) the whole structure (90049) shall be disposed of as construction debris at Fort Hood Landfill. The XRF readings of all building materials indicating an insignificant level of lead. A composite sample of demolition debris shall be obtained by the Contractor for TCLP-lead analysis and verify disposal at Fort Hood Landfill.

Asbestos-containing materials (Section 13280) and other regulated material (Section 02051) are present in these structures. The Contractor shall phase work in this section with the Contracting Officer Representative (COR).

The Contractor shall provide worker protection in accordance with 29 CFR 1926 Section .62 and perform initial assessment and worker exposure monitoring for all work in this section. The Contractor shall establish engineering controls, work and hygiene practices to minimize lead dust exposure to workers and environment when performing work in this section. The Contractor shall submit required plans in accordance with paragraph 1.2 SUBMITTALS and provide results to COR during abatement within 48 hours after completion of sampling. Disposal procedures are discussed in paragraph 3.6.6 DISPOSAL.

The Contractor shall be responsible for necessary licenses, permits,

manifest, removal, disposal, worker's training, and any associated fees or other costs incurred in this section.

1.5 SITE VISIT

Contractor shall visit, investigate the site, review the drawings and specifications, assess the amount of LBP abatement and debris, and become familiar with conditions which will affect the work.

1.6 LIABILITY INSURANCE FOR LBP

LBP abatement liability insurance shall be obtained without additional expense to the Government. The Contractor shall assume full responsibility and liability for the compliance with Federal, state, and local regulations pertaining to training, work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.

1.7 PROTECTION OF EXISTING WORK TO REMAIN

Abatement, storage, transportation, and disposal work shall be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, the Contractor shall restore work and areas to the original condition.

1.8 COORDINATION WITH OTHER WORK

Abatement and disposal work shall be coordinated with existing work and/or concurrent work being performed in adjacent areas. Employees in adjacent work areas shall be removed, if possible, during lead abatement activities.

1.9 SAFETY AND HEALTH REGULATORY REQUIREMENTS

Work shall be performed in accordance with requirements of EM 385-1-land applicable regulations including, but not limited to 29 CFR 1910, 29 CFR 1926, especially Section .62. Matters of interpretation of the standards shall be submitted to the appropriate agency for resolution before starting work. Where these requirements vary, the most stringent shall apply. All employees in adjacent work areas shall be removed where possible during lead abatement activities.

1.10 PRECONSTRUCTION MEETING

The Contractor and the Competent Person shall attend a preconstruction meeting prior to starting any work involving LBP abatement. Items required to be submitted will be reviewed for completeness, and where specified, for acceptance.

1.11 ACCIDENT PREVENTION PLAN

1.11.1 Preparation and Implementation

The Accident Preparation Plan (APP) shall be prepared in accordance with EM 385-1-1, Appendix A. Where topic in Appendix A is not applicable, the APP shall justify its omission or reduced level of detail, and establish that adequate consideration was given to the topic. The APP shall cover on-site work by the Contractor or subcontractors. The Competent Person shall be responsible for development, implementation, and quality control of the content and actions required in the APP. For each anticipated work task,

the APP shall establish hazards and control measures. The APP shall be easily readable and understandable by the Contractor's work force.

1.11.2 Acceptance and Modifications

The APP shall be prepared, signed and dated by the Contractors Competent Person and submitted 20 calendar days prior to the preconstruction meeting.

Deficiencies in the APP shall be discussed at the Preconstruction Safety Conference and the APP shall be revised to correct the deficiencies, and resubmitted for acceptance. On-site work shall not begin until the APP has been accepted unless otherwise authorized by the Contracting Officer. One copy of the APP shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to personnel on the site. As work proceeds, the APP shall be adapted to new situations and conditions. Changes to the APP shall be made with concurrence of the Competent Person and Site Superintendent, and acceptance of the Contracting Officer. Should an unforeseen hazard become evident during performance of the work, the Competent Person shall bring such hazard to the attention of the Superintendent and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, the Contractor shall take necessary action to re-establish and maintain safe working conditions; and to safeguard on-site personnel, visitors, the public, and the environment. Disregard for provisions of this specification, or the accepted APP, shall be cause for stopping of work until the matter is rectified.

1.11.3 Activity Hazard Analyses

An Activity Hazard Analysis (AHA) shall be prepared prior to beginning each major phase of the work and submitted for review and acceptance. Format shall be in accordance with EM 385-1-1, Section 1, Figure 1-1. A major phase of work is defined as an operation involving hazards not experienced in previous operations, or where a new work crew is to perform. The analysis shall define the activities and the sequence in which they are to be performed, specific hazards anticipated, and control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analysis has been accepted and a preparatory meeting has been conducted by the Contractor to discuss content of the AHA with everyone engaged in the activity, including the Government's on-site representative. The AHA shall be continuously reviewed and modified when appropriate to address changing conditions or operations. The accepted AHA shall be appended to and become part of the APP.

1.12 RESPIRATORY PROTECTION PROGRAM

A respiratory protection program shall be established as required by 29 CFR 1926 Section .103 and .62 and in accordance with 29 CFR 1910 Section .134. An approved respirator shall be furnished to each employee and visitor required to enter a LBP work control area. A fit test shall be conducted in accordance with 29 CFR 1926 Section .62, Appendix D.

1.13 HAZARD COMMUNICATION PROGRAM

A Hazard Communication Program shall be implemented in accordance with 29 CFR 1926 Section .59.

1.14 SAFETY AND HEALTH OVERSIGHT

The Competent Person shall be the on-site person responsible for coordination, safety, security and execution of the work. The Competent Person shall be able to identify existing and predictable lead hazards and shall have the authority to take corrective measures to eliminate them. The Competent Person shall be responsible for the initial assessment, worker exposure monitoring during abatement, and sampling required for abatement work, unless it is specified otherwise in the Contractor's LBP Management plan.

1.15 PREPARATORY INSPECTION MEETING

The Contractor, the Contractor's Competent Person, and the Contracting Officer's representative shall arrange and hold a preparatory inspection meeting immediately prior to beginning any LBP abatement. The APP, Activity Hazard Analyses, and the Contractor's LBP Management Plan, including containment, engineering controls, worker protection, training, and monitoring, will be reviewed for completeness.

1.16 TRAINED AND COMPETENT PERSONNEL

Work shall be performed by Competent Persons, qualified and trained in the abatement, enclosure, encapsulation, monitoring, testing, storage, treatment, hauling, and disposal of contaminated LBP debris material, and in subsequent cleanup of the affected environment. Workers shall comply with the appropriate Federal, state, and local regulations which mandate training requirements and work practices and shall be capable of performing the work under this contract.

1.17 POSTED WARNINGS AND NOTICES

The following regulations, warnings, and notices shall be posted at the work site in accordance with 29 CFR 1926 Section .62.

1.17.1 Regulations

Two copies of applicable Federal, state, and local regulations and NIOSH OSHA Booklet 3142 shall be maintained. One copy shall be posted at the work site and one copy shall be on file in the project office.

1.17.2 Warning Signs and Labels

Warning signs shall be provided at building entrances and approaches to LBP control areas containing airborne LBP debris. Signs shall be located at a distance from the LBP control areas that will allow personnel to read the sign and take the necessary protective actions required before entering the LBP control area.

1.17.2.1 Warning Signs

Warning signs shall be in English and Spanish and be of sufficient size to be clearly legible and display the following:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

1.17.2.2 Warning Labels

Warning labels shall be in English and Spanish and be of sufficient size to be clearly legible and display the following:

CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE OR LOCAL REGULATIONS.

1.17.3 Worker Information

Right-to-know notices shall be placed in clearly visible areas of the work site in compliance with Federal, state, and local regulations.

1.17.4 Air Monitoring Results

Daily air monitoring results shall be prepared so as to be easily understood by the workers, and shall be placed in a clearly visible area of the work site.

1.17.5 Emergency Telephone Numbers

A list of telephone numbers shall be posted at the site. The list shall include numbers of the local hospital, emergency squad, police and fire departments, Government and Contractor representatives who can be reached 24 hours per day, and professional consultants directly involved in the project.

1.18 EQUIPMENT AND MATERIALS

Sufficient quantities of health and safety materials required by 29 CFR 1926 Section .62, and other materials and equipment needed to complete the project, shall be available and kept on the site.

1.18.1 Respirators

Air-purifying respirators shall be approved by NIOSH for use with dust, fumes, and mists having permissible exposure limits less than 0.05 milligrams per cubic meter (i.e., have high-efficiency particulate air (HEPA) filters) and for other hazardous airborne contaminants that may be encountered, as determined by the Competent Person. Respirators shall comply with the requirements of 29 CFR 1926 Section .62 and shall be used in accordance with 29 CFR 1926 Section .103 and 29 CFR 1910 Section .134.

1.18.2 Respirator Cartridges

A sufficient supply of respirator cartridges shall be maintained at the work site to provide new cartridges to employees, authorized visitors, and Government personnel throughout the duration of the project. Cartridges shall be replaced according to the manufacturer's recommendations, when breathing becomes difficult, or if the cartridge becomes wet.

1.18.3 Protective Clothing

The Contractor shall furnish, at no cost to personnel, equipment/clothing for protection from airborne and waterborne LBP debris. An adequate supply of these items shall be available for worker, authorized visitor, and Government personnel use. Workers and visitors shall not take protective clothing and equipment off the work site at any time. Protective clothing

includes:

- a. Coveralls (Whole Body Protective Coverings): Full-body coveralls and head covers shall be worn by workers in the work area. Sleeves shall be secured at the wrist and pants legs at the ankle with tape. Permeable clothing shall be provided in heat-stress conditions. Where non-disposable coveralls are provided, these coveralls shall be cleaned after each wearing. Cleaning of coveralls and other non-disposable clothing shall be in accordance with the provisions for cleaning in 29 CFR 1926 Section .62.
- b. Boots: Work boots with non-skid soles or impermeable work boot covers shall be worn by workers. Where required by OSHA, safety boots (steel toe or steel toe and shank) shall be worn. Paint the uppers of boots red with waterproof enamel. Do not allow boots to be removed from the work area for any reason after being contaminated with LBP debris. Dispose of boots as LBP contaminated waste at the end of the work.
- c. Gloves: Inner gloves, appropriate for items and hazards encountered, and disposable outer work gloves shall be provided to each worker and shall be worn while the worker is in the work area. Glove material shall be appropriate for the specific chemical exposure. Gloves shall not be removed from the work area, and shall be disposed of as LBP contaminated waste at the end of the work.
- d. Hard Hats: Head protection (hard hats) shall be provided as required by OSHA and EM 385-1-1 for workers and authorized visitors. Protective plastic strap suspension hats shall be used. Hard hats shall be worn at all times that work is in progress. Hats shall remain in the work area until the project is completed. Hats shall be thoroughly cleaned, decontaminated, and bagged before being removed from the work area at the end of the project.
- e. Eye Protection: Fog-proof goggles for personnel engaged in LBP abatement operations shall be worn when the use of a full face piece respirator is not required.
- f. Work Clothing: Cloth work clothes shall be provided for wearing under the disposable protective coveralls and foot coverings.

1.18.4 Expendable Supplies

1.18.4.1 Polyethylene Sheet and Bags - General

Polyethylene sheet and bags shall be minimum 0.15 mm (6 mils) thick. Bags shall have pre-printed labels, and 125 mm (5 inch) (minimum) long plastic ties, pointed and looped to secure the filled bags. Polyethylene sheets shall be in roll sizes to minimize seams.

1.18.4.2 Polyethylene Sheet - Flame Resistant

Where a potential for fire exists, flame-resistant polyethylene sheets shall be provided. Polyethylene film shall be frosted and shall conform to the requirements of NFPA 701.

1.18.4.3 Polyethylene Sheet - Reinforced

Reinforced polyethylene sheet shall be provided where high skin strength is required such as where it constitutes the only barrier between the LBP control area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

1.18.4.4 Tape and Adhesive Spray

Tape and adhesive shall be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive shall retain adhesion when exposed to wet conditions, including amended water. Tape shall be minimum 50 mm (2 inches) wide, industrial strength.

1.18.4.5 Containers

Impermeable containers shall be used to receive and retain lead contaminated material until disposal. Containers shall be labeled in accordance with EPA, DOT and OSHA standards.

1.18.4.6 Chemicals

Chemicals, including caustics and paint strippers, shall be properly labeled and stored in leak-tight containers.

1.18.5 Vacuum Systems

HEPA filtered vacuum systems shall be used during abatement operations which generate dust. The systems shall be suitably sized for the project, and filters shall be capable of removing particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.

1.18.6 Heat Blower Guns

Heat blower guns shall be flameless, electrical, paint-softener type with controls to limit temperature to 590 degrees C (1,100 degrees F). Heat blower shall be DI (non-grounded) 120 Vac, and shall be equipped with cone, fan, glass protector and spoon reflector nozzles.

1.18.7 Chemical Paint Strippers

Chemical paint strippers shall contain no methylene chloride and shall be formulated to prevent stain, discoloration, or raising of the substrate materials.

1.18.8 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers shall be used on exteriors only and shall be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

1.19 STORAGE OF MATERIALS

Materials shall be stored in a place and manner which protects them from damage and contamination. During periods of cold weather, plastic materials shall be protected from the cold. No flammable or hazardous materials shall be stored inside any building. Regularly inspect materials to identify damaged or deteriorating items. Damaged or deteriorated items

shall not be used and shall be removed from the site as soon as they are discovered. Any materials which become contaminated with LBP waste shall be disposed of consistent with the requirements of 40 CFR 148 and these specifications. Stored materials shall not present a hazard or an inconvenience to workers, visitors, and/or other occupants and employees of the building.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 NOT USED

3.2 WORK PROCEDURES

LBP abatement and related work shall be performed in accordance with the accepted Contractor's LBP Management Plan. Procedures and equipment required to limit occupational and environmental exposures to lead during LBP removal shall be in accordance with 29 CFR 1926 Section .62, and as specified herein. Paint chips and associated waste shall be disposed of in compliance with Federal, state, and local regulations.

3.2.1 Personnel Protection Procedures

Personnel shall wear and use protective clothing and equipment as specified. Eating, smoking, drinking, chewing tobacco and chewing gum, and applying makeup shall not be permitted in the LBP control area. Personnel of trades not engaged in the abatement and disposal of LBP shall not be exposed at any time to airborne concentrations of lead equal to or in excess of 30 micrograms per cubic meter (ug/m3) of air. Electrical service shall be disconnected when wet removal is performed, and temporary electrical service protected by a ground fault circuit interrupter shall be provided.

3.2.2 Safety and Health Procedures

The Competent Person shall be present on the work site throughout the abatement project to supervise, monitor, and document the project's health and safety provisions. A daily log shall be maintained showing the results of sampling tests throughout the project area.

3.2.3 Safety and Health Responsibilities

The Competent Person shall:

- a. Verify that training meets applicable requirements.
- b. Review and approve LBP Management Plan for conformance to the applicable referenced standards.
- c. Inspect LBP removal work for conformance with the accepted LBP Management Plan.
- d. Ensure that worker exposure air monitoring activities are in accordance with 29 CFR 1926 Section .62.
- e. Ensure work is performed in strict accordance with specifications.
- f. Minimize exposure to personnel and to the environment.

The Competent Person shall be responsible for directing personal and environmental air monitoring, and lead dust wipe sampling (if necessary).

3.2.4 Medical Surveillance Procedures

Medical surveillance shall be implemented in accordance with the approved Contractor's LBP Management Plan, and shall comply with the requirements of 29 CFR 1926 Section .62, including the provisions for biological monitoring, medical removal protection and a physician's written opinion, signed by the physician performing the employee examination. The Contractor shall provide a copy of the written opinion for Contractor's employees 2 days prior to each employee's commencement of work.

3.2.5 Engineering Controls and Containment Structures

3.2.5.1 LBP Control Area

The LBP control area is where LBP abatement work occurs and as such shall be considered contaminated, and shall be isolated to prevent LBP containing dust or debris from passing into adjacent or open areas. The control area shall be decontaminated at the completion of the LBP abatement and disposal work.

3.2.5.2 Boundary Requirements

Physical boundaries shall be provided around exterior LBP control areas by roping off the area indicated in the LBP Management Plan. Interior projects shall be isolated by curtains, portable partitions, or other enclosures to ensure that concentrations of lead dust outside the LBP control area will not equal or exceed the pre-abatement level.

3.2.5.3 Control Barriers

The LBP control area shall be separated from other portions of the building and the outside with control barriers. The polyethylene sheeting will have all openings masked and sealed, and shall be erected according to the Contractor's LBP Management Plan. Polyethylene sheeting shall be mechanically supported, independent of duct tape or spray adhesive.

3.2.5.4 Preabatement Lead-Dust Wipe Samples

Preabatement lead-dust wipe samples shall be taken outside the LBP controlled area, in accordance with HUD-01. Samples shall be taken within 3 meters (10 feet) of the abatement structure at 20 percent of the area planned for abatement.

3.2.5.5 Masking and Sealing

- a. Interior LBP control area requirements: Openings shall be sealed where the release of airborne LBP dust is expected. A control area shall be established with the use of curtains, portable partitions, or other systems in order to prevent the escape of dust from the contaminated control area. The control area shall be provided with protective covering of two layers of polyethylene sheeting over floors. Penetrations of the floor, walls, and ceiling shall be sealed with polyethylene sheeting and duct tape. Polyethylene sheeting shall be firmly attached to the structure. Joints shall be sealed with spray adhesive and duct tape.

Openings shall be provided for the supply and exhaust of air for the negative air pressure system. Personal monitoring during the work shift shall be in accordance with 29 CFR 1926 Section .62.

3.2.5.6 Personnel Decontamination Unit Procedures

Decontamination units shall be constructed when required for the abatement procedures. Materials fabricated or delivered to the site before the shop drawings have been returned to the Contractor will be subject to rejection by the Contracting Officer. Specifications and drawings of portable prefab units, such as a trailer unit, if utilized, must be submitted for review and approval before start of construction. Submittal shall include, but not be limited to, a floor plan layout showing dimensions, materials, sizes, thicknesses, plumbing, and electrical outlets. Access between contaminated and uncontaminated rooms or areas shall be through an airlock.

Access between any two rooms or room and trailer within the decontamination unit shall be through a plastic sheeting curtained doorway.

A separate equipment decontamination unit shall be provided. Each work area shall have an emergency exit. The personnel decontamination unit's clean room shall be the only means of entrance and exit, except for emergencies, from the LBP control area. Materials shall exit the LBP control area through the equipment decontamination area.

3.2.5.7 Clean Room Procedures

The clean room shall have only one exit to non-contaminated areas of the building or site. An airtight seal shall be constructed of polyethylene between the clean room and the rest of the building. Surfaces of the clean room shall be protected with sheet polyethylene. A temporary unit with a separate equipment decontamination locker room and a clean locker room shall be provided for personnel who are required to wear whole body protective clothing. One locker shall be provided in each locker room for each LBP abatement worker, and each Contractor's representative. Lead-free personal clothing and shoes shall be kept in the clean locker. Hand wash station/showers shall be located between the equipment decontamination locker room and the clean locker room, and employees shall wash or shower before changing into personal clothes. An adequate supply of clean disposable towels shall be provided. LBP contaminated work clothing shall be cleaned. Clean rooms shall be physically attached to the LBP control area for areas inside the building but may be directly adjacent to the LBP control area outside of the building. Joint use of this space for other functions, such as offices, equipment storage, etc., is prohibited.

3.2.5.8 Hand Wash Station/Shower Room Procedures

An operational shower and hand washing station shall be provided between the work area and the clean changing room. Workers shall wash and/or shower before entering the clean changing room. Shower room shall be separated from other rooms by air tight walls fabricated from polyethylene sheeting. Water shall be hot and cold or warm. Shower heads and controls, soap dish, continuing supply of soap, and clean towels shall be provided. The shower shall be maintained in a sanitary condition. Waste water shall be pumped to drain and through waste water filters that meet state and/or local requirements. These filters shall be located inside the shower unit and filters shall be changed regularly. Spent filters shall be discarded as LBP contaminated waste.

3.2.5.9 Equipment Decontamination Unit Procedures

The Equipment Decontamination Unit shall be used for removal of equipment and materials from the LBP control area, and shall include a wash room, holding room, and an enclosed walkway. The unit shall be constructed from wood framing material and polyethylene sheeting. Workers shall not enter or exit the LBP control area through the Equipment Decontamination Unit. A washdown station, consisting of an enclosed shower unit, shall be located in the work area outside the Wash Room. The washdown station shall be used to clean equipment, bags and containers. Bagged or containerized LBP wastes shall be passed from the work area and cleaned in the Wash Room. The Wash Room shall be separated from the work area by a polyethylene sheeting flap. Wastewater shall be filtered and filters shall be changed as required for the shower unit and the Wash Room. Filters shall be disposed of as LBP contaminated wastes. The Holding Room shall be used as a drop location for bagged LBP passed from the Wash Room. This room shall be constructed so that bagged materials cannot be passed from the Wash Room through the Holding Room to the enclosed walkway. The walkway shall be separated from adjacent rooms by double flaps of 1.6 mm (1/16 inch) thick single ply rubber roofing materials of EPDM or Neoprene. The enclosed walkway shall isolate the Holding Room from the building exterior and shall be constructed of wood framing and polyethylene sheeting. The walkway shall provide access to the Holding Room from the building exterior. The enclosed walkway shall be separated from the exterior by a single flap of polyethylene sheeting.

3.2.5.10 Maintenance of Decontamination Units

Barriers and polyethylene sheeting shall be effectively sealed and taped. Containment barriers shall be visually inspected at the beginning of each work period. Damaged barriers and defects shall be immediately repaired upon discovery. Smoke methods shall be used to test effectiveness of barriers when directed by the Contracting Officer.

3.2.5.11 LBP Control Area Exiting Procedures

Personnel exiting a LBP control area shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:

- a. Vacuum all protective clothing before removing.
- b. Remove protective clothing in the decontamination room, and place this clothing in an approved impermeable disposal bag.
- c. Wash or shower.
- d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated work site.

3.2.6 Furnishings

The Government will remove furniture and equipment from the work area before LBP removal work begins. The Contractor shall coordinate this effort with the COR.

3.2.7 Building Ventilating Systems

Any building ventilating system or any other system bringing air into or out of the LBP control work area shall be shut down and isolated by lockable switch; disconnecting wires; removing circuit breakers; isolated

by airtight seals, or other positive means that will prevent spread of contamination through the system. Airtight seals shall consist of 2 layers of polyethylene. Individual seals shall be applied to ventilation openings (supply and exhaust), lighting fixtures, clocks, windows, doorways, elevator doors, stairs, ramps, speakers, and other openings into the work area. Seals shall be maintained until project decontamination is completed. After decontamination work has been completed and final air sample testing proves that the area is decontaminated, seals shall be removed and the ventilating systems may be operated again.

3.2.8 Temporary Utilities

Temporary equipment to provide adequate power, light, heat, and water shall be installed to accomplish the abatement operations properly and safely. The Contractor shall maintain the security and maintenance of the utility system in the LBP control areas. In the event of a failure of any utility system, the Government will not be responsible for any loss of time or other expense incurred by the Contractor. Wiring and electrical service shall be as specified in to Section 16415 Electrical Work, Interior or Section 16370 Electrical Distribution System, Aerial. In addition, the Contractor shall provide:

- a. Backflow protection on all water connections. Fittings installed by the Contractor shall be removed after completion of work with no damage or alteration to existing water piping and equipment.
- b. Heavy-duty abrasion-resistant hoses to provide water to each work area and decontamination area.
- c. A hot water heater, if hot water is not supplied through the building's existing water supply to the decontamination showers.
- d. Electrical service to work areas. Electrical service shall comply with NEMA, NECA, and UL standards. Warning signs shall be posted at power outlets which are other than 110-120 volt power. Only grounded extension cords shall be used. Incandescent lamps and light fixtures shall be of adequate wattage to provide good illumination in LBP control areas.
- e. Temporary heating units, when needed, that have been tested and labeled by UL, FM, or another recognized trade association related to the fuel being consumed. Forced air or fan type units shall not be utilized inside a work area. Units shall have tip-over protection.
- f. Sufficient quantity of single-occupant, self-contained chemical toilets, properly vented and fully enclosed, if permanent toilets are not available.

3.3 LBP ABATEMENT METHODS

3.3.1 Whole Component Removal

The painted wood components shall be removed and disposed of in their entirety.

3.3.2 Not Used

3.3.3 Not Used

3.3.4 Not Used

3.3.5 Not Used

3.3.6 Not Used

3.3.7 Chemical Stripping

The Contractor shall have choice of LBP removal method for the yellow safety striping from concrete substrate. The choice of LBP removal method shall be identified on the Contractor's LBP Management Plan. Chemical strippers containing methylene chloride are prohibited. Chemical stripping shall take place on-site. Stripping shall be done according to manufacturer's recommendations and the accepted Contractor's LBP Management Plan. Substrates shall be thoroughly washed and neutralized. Waste generated by the stripping process shall be handled in accordance with the accepted Contractor's Waste Management Plan, Waste Handling and Site Storage Plan. Adjacent finishes (i.e beams, walls and floors) shall be protected to prevent contamination.

3.3.8 Not Used

3.3.9 Vacuum Blasting

The Contractor shall have choice of LBP removal method for the yellow safety stripping on metal substrate (hydrant fueling pit). The choice of LBP removal method shall be identified on the Contractor's LBP Management Plan. The vacuum blasting system shall have HEPA filter. Work shall be performed in a LBP control area using negative pressure full containment with HEPA filtered exhaust. Paint residue shall be handled in accordance with the accepted Contractor's Waste Management Plan, Waste Handling and Site Storage Plan.

3.3.10 Needle Gun

The Contractor shall have choice of LBP removal method for the safety stripping on metal substrate. The choice of LBP removal method shall be identified on the Contractor's LBP Management Plan. The needle gun shall be fitted to HEPA vacuum systems. Work shall be performed in a LBP control area using negative pressure full containment with HEPA filtered exhaust. Paint residue shall be handled in accordance with the accepted Contractor's Waste Management Plan, Waste Handling and Site Storage Plan Waste Management Plan.

3.4 MONITORING

During the entire LBP removal and disposal operations, a Competent Person shall be on-site directing the monitoring/sampling and inspecting the work to ensure that the health and safety requirements of this contract are satisfied.

3.4.1 Personal Air Monitoring

Airborne concentrations of lead shall be collected and analyzed in accordance with 29 CFR 1926 Section .62. Results shall be reported in micrograms per cubic meter of air. The Competent Person shall use personal air monitoring results to determine the effectiveness of engineering controls, the adequacy of PPE and to determine if proper work practices are

being employed. The Contracting Officer shall be notified if any personal air monitoring result equals or exceeds 30 micrograms per cubic meter of air. The Contractor shall take steps to reduce the concentration of lead in the air.

3.4.2 Wipe Sampling

Wipe sampling for surface lead dust concentrations shall be conducted in accordance with ASTM E1792 for wipe sample materials and HUD-01. Wipe sampling shall be conducted at:

- a. Preabatement to establish a baseline when performing LBP abatement.
- b. Not Used.
- c. Post abatement to determine if specified clearance criteria has been met. The clearance standards are:

Floors: 100 ug/sq. ft.
Exterior: 800 ug/sq. ft.

3.4.2.1 Preabatement

Preabatement wipe samples shall be collected outside the LBP control area in accordance with paragraph Preabatement Lead-Dust Wipe Samples. Samples outside the LBP control work area shall be collected at critical barriers, in the clean room of the decontamination unit and in traffic control areas such as personal and equipment entrances.

3.4.2.2 to 3.4.2.4 Not Used

3.4.2.3 Post Abatement

Post abatement samples shall be collected in accordance with paragraph Final Clearance Testing.

3.4.3 Not Used

3.4.4 Waste Sampling and Testing

Sampling and testing of all waste in the paragraph 1.4 DESCRIPTION OF WORK shall be in accordance with 40 CFR 261.

3.4.5 Soil Sampling

Soil sampling is necessary to determine if total lead content in soil adjacent to B/90050 is affected by LBP soffit fascia board or during abatement. Soil contamination during abatement or from accidental spillage shall be the responsibility of the Contractor, therefore, soil removal, testing, and disposal shall be conducted by the Contractor at no additional cost to the government.

3.4.5.1 Pre-abatement or Background Soil Sampling

Baseline total lead level in soil shall be obtained by composite soil sampling within the drip line of B/90050. Five (5) small portions of surface soil shall be scooped with a fresh 50 mL plastic centrifuge tube and composited in the tube. This will represent a single composite sample. The laboratory shall utilize procedures in EPA Method 6010 for Total Lead

analysis.

3.4.5.2 Post Abatement

Post abatement soil samples shall be collected in the same manner as the pre-abatement sample for B/90050 or at any spillage location. If soil samples has Total Lead levels at or above 400 mg/kg, the Contractor will be required to perform soil excavation to a depth of 50 mm in the area. The soil shall be removed, tested, and disposed as specified in paragraph CLEANUP AND DISPOSAL.

3.5 ADJACENT AREAS

Damage to adjacent areas shall be repaired to the approval of the Contracting Officer.

3.6 CLEANUP AND DISPOSAL

3.6.1 Cleanup

3.6.1.1 Daily

Surfaces in the LBP control area shall be maintained free of accumulations of paint chips and dust. Spread of dust and debris shall be restricted; waste shall not be distributed over the work area. Dry sweep or compressed air shall not be used for cleanup. At the end of each shift, the area shall be cleaned of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet mopping the area. LBP abatement work shall cease during the cleanup.

3.6.1.2 Prior to Clearance

Upon completion of the lead paint abatement and a satisfactory visual inspection by the Contracting Officer in a given work area, a preliminary clean-up shall be performed by the Contractor. This clean-up includes removal of any contaminated material, equipment or debris including polyethylene sheeting from the work area, except for critical barriers. The polyethylene sheeting shall be sprayed or misted with water for dust control, abatement debris removed and then the sheeting removed by folding it in upon itself. Polyethylene sheeting used for critical barriers shall remain in place until final clearance criteria. The following methodology shall be utilized during the cleanup prior to clearance.

- a. Lead-contaminated debris shall be containerized in accordance with paragraph Contaminated Waste. Waste bags shall not be overloaded, shall be securely sealed and stored in the designated area until disposal.
- b. Non-contaminated debris shall be containerized; removed from the work area and stored in the designated area until disposal in accordance with paragraph Non-Contaminated Waste.
- c. Removal of surface polyethylene sheeting shall begin from upper levels such as cabinets and shelves. Removal of floor polyethylene sheeting shall begin at the corners and folded in the middle to contain the dust. Polyethylene shall be disposed of as specified for debris.
- d. Cleaning. Once the polyethylene sheeting, except critical

barriers is removed from the work area, cleaning shall begin. It shall be done in the following sequence: HEPA Vacuum; Tri-Sodium Phosphate (TSP) wash (or equivalent cleaner); and HEPA Vacuum.

- e. HEPA Vacuum. Vacuum all surfaces. Begin with ceilings and proceed down the walls, including window, doors, door trim and ending with floors. Begin vacuuming at the furthest corner from the entrance to the work area.
- f. Wet Wash. Wash or mop the surfaces vacuumed in the same sequence. Contractor shall utilize a tri-sodium phosphate (TSP) detergent solution or other equally effective cleaning agent and allow surface to dry.
- g. Cleaning Equipment. The Contractor shall prepare and use detergents containing five to ten percent TSP or other equally effective cleaning agent which shall be used in accordance with the manufacturers instructions. The waste water from cleaning shall be contained and disposed of according to applicable Federal, state, county and local regulations and guidelines. The waste water shall not be disposed of in storm sewers or sanitary sewers without specific and written Government approval.

3.6.2 Visual Inspection

Upon completion of the final cleaning, the Contractor shall notify the Contracting Officer and request a final visual inspection with the Contracting Officer's representative with the criteria in the final cleaning/visual inspection example format sheet located at the end of this section. If the area does not pass the visual inspection, the Contractor shall re-clean the area as required by paragraph CLEANUP AND DISPOSAL, at no additional expense to the Government. Final clearance testing shall not proceed until the Contracting Officer has accepted the final cleaning by the Contractor.

3.6.3 Final Clearance Testing

Final clearance surface dust sampling shall be conducted for the paint abatement task, after a thorough cleanup has been completed in accordance with the following:

On-site paint removal in limited areas. Three samples shall be taken from the floor in each area abated and one sample outside the containment area (within ten feet). Pre-abatement wipe samples shall be compared to determine if dust from the abatement process has contaminated non-abated areas. The Contractor shall cleanup these areas if contamination from the abatement process occurs.

Retests. If laboratory results indicate that the wipe test clearance level is exceeded, the Contractor shall re-clean the affected area, at no additional cost to the Government. The Contractor shall utilize specified cleaning methods. Retesting will then be performed to determine if specified clearance criteria was met. The Contractor shall pay for additional testing and shall provide, at no additional cost, a recleaning of an affected area until the clearance level is achieved. See paragraph 3.4.2 Wipe Sampling, for clearance standards.

3.6.4 Certification

The Competent Person shall certify in writing that inside the LBP control area and the area external to the LBP control area met final clearance requirements.

3.6.5 Removal of Control Area

After approval of the final clearance certification, and when authorized by the Contracting Officer, the LBP control area, containment barriers, and control structures roped-off boundary and warning signs shall be removed.

3.6.6 Disposal

3.6.6.1 Toxicity Characteristic Leaching Procedure (TCLP) Results

The results of the TCLP analysis, in accordance with 40 CFR 261, performed during abatement shall be used to determine disposal procedures.

Hazardous waste, has TCLP-lead result greater than or equal to 5 mg/l, shall be treated at a hazardous waste treatment facility and prior approval by TNRCC is required.

Class I waste, has TCLP-lead result greater than or equal to 1.5 mg/l but less than 5.0 mg/l, shall be managed as special waste and disposed of in a Type I municipal landfill with a dedicated special waste trench or a permitted industrial landfill. Class I waste shall require approval by TNRCC prior to disposal.

Class II waste, has TCLP-lead result less than 1.5 mg/l, shall be managed as construction debris and disposed of in a Type I/IAE, Type IV, or a permitted industrial landfill without prior approval by TNRCC.

Fort Hood Landfill at Turkey Run Road and Clarke Road will accept waste with TCLP lead result of less than 5.0 mg/l.

3.6.6.2 Contaminated Waste

Lead-contaminated waste, scrap, and debris shall be disposed of as follows:

- a. Lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing, which may produce airborne concentrations of lead particles shall be stored in U.S. Department of Transportation 49 CFR 178 approved 200 liter (55 gallon) drums. Each drum shall be labeled to identify the type of waste as defined in 49 CFR 172 and the date lead-contaminated wastes were first put into the drum. The Uniform Hazardous Waste Manifest forms from Federal and state agencies shall be obtained and completed. Land disposal restriction notifications shall be as required by 40 CFR 268. The Contracting Officer shall be notified at least 14 days prior to delivery to arrange for job site inspection of the drums and manifests. Lot deliveries of hazardous wastes shall be made as needed to ensure that drums do not remain on the work site longer than 90 calendar days from the date affixed to each drum. Contractor shall prepare a Waste Management and Site Storage Plan to identify interim storage location.
- b. Lead-contaminated waste shall be handled, stored, transported, and disposed of in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262,

40 CFR 263, 40 CFR 264, and 40 CFR 265. Land disposal restriction notification shall be as required by 40 CFR 268.

- c. Lead-contaminated soil shall be handled, stored, transported, and disposed of in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Land disposal restriction notification shall be as required by 40 CFR 268. Removed lead-contaminated soil shall be stockpiled at an approved location by the COR and a representative soil sample shall be obtained from each 40 cubic meters and analyzed for TCLP-lead for disposal.

3.6.6.3 Non-Contaminated Waste

Non-contaminated waste, scrap, and debris from the building structure shall be disposed of as construction debris.

3.6.7 Disposal Documentation

Written evidence shall be provided that the hazardous waste treatment, storage, or disposal facility is approved for lead disposal by the EPA and state or local regulatory agencies. One copy shall be submitted of the completed manifest; signed, and dated by the initial transporter in accordance with 40 CFR 262.

3.6.8 Title to Materials

Materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor, for the duration of this contract, and shall be disposed of in accordance with Section 02220 DEMOLITION, except as specified herein.

3.6.9 Payment

Payment for disposal of waste will not be made until a Final Disposition Report is submitted and accepted by the COR, and a signed copy of the manifest or disposal receipt from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Government.

CERTIFICATION OF FINAL CLEANING AND VISUAL INSPECTION

Individual abatement task as identified in paragraph,
Description of Work_____

In accordance with the clearing and decontamination procedures specified in the Contractor's lead hazard abatement plan and this contract, the Contractor hereby certifies that he/she has thoroughly visually inspected the decontaminated regulated work area (all surfaces, including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) and has found no dust, debris, or lead containing material residue.

BY: (Contractor's signature)_____

Date_____

Print name and

title_____

(Contractor's On-site Supervisor signature)_____

Date_____

Print name and

title_____

(Contractor's Competent Person signature)_____ Date_____

Print name and

title_____

CONTRACTING OFFICER ACCEPTANCE OR REJECTION

The Contracting Officer hereby determines that the Contractor has performed final cleaning and visual inspection of the decontaminated regulated work area (all surfaces including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) and by quality assurance inspection, finds the Contractor's final cleaning to be:

_____ Acceptable

_____ Unacceptable, Contractor instructed to re-clean the LBP control work area

BY: Contracting Officer's Representative

Signature_____

Date_____

Print name and

title_____

-- End of Section --

BASE BID

DETAILED REPORT OF LEAD PAINT INSPECTION FOR:
ROBERT GRAY ARMY AIRFIELD - BUILDING 90071 (VEHICLE SCALE)

Inspection Date: 11/16/99
Report Date: 11/22/99
Abatement Level: 1.0
Report No. S#01360 - 11/16/99 17:55
Total Readings: 7
Job Started: 11/16/99 17:55
Job Finished: 11/16/99 18:32

READ NO.	ROOM NAME	SUBSTRATE	STRUCTURE	PAINT COLOR	LEAD (mg/cm ²)
001	Exterior	Concrete	Border	Yellow	6.1
002	Exterior	Concrete	Border	Yellow	2.1
003	Exterior	Metal	Perimeter Band	Red	0.0
004	Exterior	Metal	Control Panel Box	Red	0.0
005	Exterior	Metal	Hatch Door	Red	0.0
006	Calibration Block				1.0
007	Wood Block				0.0

----- End of Readings -----

DETAILED REPORT OF LEAD PAINT INSPECTION FOR:
ROBERT GRAY ARMY AIRFIELD - BUILDING 90079

Inspection Date: 11/16/99
Report Date: 11/22/99
Abatement Level: 1.0
Report No. S#01360 - 11/16/99 18:33
Total Readings: 41
Job Started: 11/16/99 18:33
Job Finished: 11/17/99 13:41

READ NO.	ROOM NAME	SUBSTRATE	STRUCTURE	PAINT COLOR	LEAD (mg/cm ²)
001	Calibration Block				1.0
002	Calibration Block				1.0
003	Calibration Block				1.0
004	Wood Block				-0.1
005	Wood Block				-0.1
006	Wood Block				-0.2
007	Exterior	CMU	Wall	Beige	-0.1
008	Exterior	Metal	Siding	Beige	0.1
009	Exterior	Metal	Door	Beige	0.0
010	Exterior	Concrete	Baseboard	Beige	-0.2
011	Exterior	CMU	Wall	Beige	-0.1
012	Exterior	Concrete	Baseboard	Beige	0.0
013	Exterior	Metal	Door Casing	Beige	0.2
014	Exterior	Metal	Door	Beige	0.0
015	Mechanical Rm	CMU	Wall	Beige	0.0
016	Break Rm	Metal	Vertical I-Beam	Beige	0.0
017	Janitor Closet	Fiber Board	Wall Interior	Beige	0.0
018	Lunch Rm	Concrete	Beam Interior	Beige	-0.1
019	Lunch Rm	CMU	Wall Interior	Beige	-0.1
020	Flight Office	Sheetrock	Column	Beige	0.0
021	Entrance Rm	CMU	Wall	Beige	0.0
022	Entrance Rm	Sheetrock	Column	Beige	-0.1
023	Flight Office	Metal	Door Casing	Beige	0.0
024	Flight Office	Metal	Door	Beige	0.1
025	Stairway	Sheetrock	Wall	Beige	0.0
026	Stairway	Metal	Baseboard	Beige	0.0
027	Stairway	Metal	Riser	Beige	0.0
028	Stairway	CMU	Wall	Beige	0.0
029	Stairway	Metal	Handrail	Beige	0.3
030	Tower Rm	Sheetrock	Wall	White	0.0
031	Tower Exterior	Metal	Door	Brown	0.0
032	Main Rm	CMU	Wall	Beige	-0.1
033	Main Rm	Sheetrock	Column	Beige	0.0
034	Womens Restroom	Metal	Stall Door	Blue	0.0
035	Womens Restroom	Sheetrock	Ceiling	Beige	-0.1
036	Calibration Block				1.0
037	Calibration Block				1.0
038	Calibration Block				1.0
039	Wood Block				0.0
040	Wood Block				0.0
041	Wood Block				0.0

----- End of Readings -----

DETAILED REPORT OF LEAD PAINT INSPECTION FOR:
ROBERT GRAY ARMY AIRFIELD - BUILDING 90080

Inspection Date: 11/16/99
Report Date: 11/22/99
Abatement Level: 1.0
Report No. S#01360 - 11/16/99 15:49
Total Readings: 27
Job Started: 11/16/99 15:49
Job Finished: 11/16/99 17:38

READ NO.	ROOM NAME	SUBSTRATE	STRUCTURE	PAINT COLOR	LEAD (mg/cm ²)
001	Calibration Block				1.3
002	Calibration Block				1.0
003	Calibration Block				1.0
004	Wood Block				-0.2
005	Wood Block				0.0
006	Wood Block				0.0
007	Interior	Wood Panel	Lower Wall	Beige	0.0
008	Interior	Metal	Door Casing	Beige	0.0
009	Interior	Metal	Door	Brown	0.0
010	Interior	Drywall	Wall	Beige	-0.1
011	Interior	Wood	Lower Wall	Beige	-0.1
012	Interior	Wood	Lower Wall	Beige	-0.1
013	Interior	Metal	Support Arch	Beige	0.0
014	Admin. Room	Wood Panel	Wall	Beige	-0.1
015	Admin. Room	Wood Panel	Wall	Beige	-0.1
016	Utility Closet	Drywall	Wall	Beige	0.0
017	Ladies Room	Drywall	Wall	Beige	-0.1
018	Mens Room	Drywall	Wall	Beige	-0.1
019	Interior	Wood	Ladder	Beige	-0.1
020	Exterior	Metal	Door	Brown	0.0
021	Exterior	Steel	Approach Pole	Beige	0.0
022	Exterior	Metal	Roll Door	White	0.4
023	Exterior	Metal	Wall	Beige	0.3
024	Calibration Block				1.0
025	Calibration Block				1.0
026	Wood Block				0.0
027	Wood Block				-0.1

----- End of Readings -----

ENVIRONMENTAL TESTING & CONSULTING, INC.
2924 Walnut Grove Road - Memphis, TN 38111 - (901)327-2750
INORGANIC ANALYSIS DATA SHEET

Client Name **Quest Micro Analytics, Inc.**
2530 Electronic Lane, Ste 712
Dallas, TX 75220-1229

Project #
FID #

Site ID Ft Hood Bldg. 90071

Date Arrived 11/22/99
ETC Order Number 9911591

ETC Lab ID 9911591-01
Sample ID: 90071-T01

Matrix :SOLID
Sample Date :11/16/99

TEST	RESULT UNITS: (mg/L)	DL	DATE EXTRACTED	DATE ANALYZED	BY	METHOD
TCLP Extraction	Leachate		11/22/99		TL	1311
Lead - TCLP	ND	0.315		11/24/99	SH	6010B

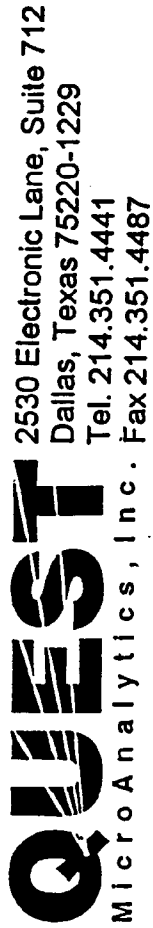
DL - Detection Limit ND - Not Detected


LABORATORY MANAGER

CHAIN OF CUSTODY RECORD

[illegible]

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT



99159

[illegible]



ENVIRONMENTAL TESTING & CONSULTING, INC.
2924 Walnut Grove Road • Memphis, TN 38111 • (901) 327-2750 • FAX (901) 327-6334

Founded 1972

November 29, 1999

Ms. Jennifer Jaber
Quest Micro Analytics, Inc.
2530 Electronic Lane, Ste 712
Dallas, TX 75220-1229

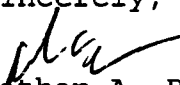
Ref: Analytical Testing
ETC Order # 9911591
Project Description Ft Hood Bldg. 90071

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with Standard Methods 17th/18th Edition; The Solid Waste Manual SW-846; EPA Methods for the Analysis of Water and Wastes and/or 40 CFR part 136.

The results are shown on the attached analysis sheet(s).

Please do not hesitate to contact our office if you have any questions.

Sincerely,


Nathan A. Pera, IV
Chief Executive Officer

rt
Attachment

QUEST

Certifications

Tennessee	#TN02027
Arkansas	
Alabama	#40730
Kentucky	#90047
North Carolina	#415
South Carolina	#84002002

Mississippi	
Oklahoma	#9311
Virginia	#00106
Washington	#C248
US Army Corps of Engineers	

BID OPTION NO. 1

SEQUENTIAL REPORT OF LEAD PAINT INSPECTION FOR BUILDING 90050
WEST FORT HOOD FIRE STATION

Inspection Date: 04/13/99
Report Date: 12/2/99
Abatement Level: 1.0
Report No. S#01360 - 04/13/99 21:31
Total Readings: 38
Job Started: 04/13/99 21:31
Job Finished: 04/14/99 15:47
Inspector: Bill Bird and Jack Cronkite

Read No.	Room Name	Substrate	Structure	Paint Color/Cond.	Lead (mg/cm ²)
01	Calibration	Block			1.0
02	Calibration	Block			1.0
03	Calibration	Block			0.9
04	Calibration	Block			1.0
05	Calibration	Block			0.9
06	Roof	Wood	Soffit	Brown/Poor	7.5
07	No Record	Not Record	No Record	-----	1.5
08	Workout	Drywall	Wall Board	Yellow/Good	0.0
09	"	Wood	Window Facing	"	-0.1
10	"	Wood	Window Trough	"	0.0
11	"	Wood	Door	Varnished/Good	-0.1
12	"	Wood	Door Stop	Light Gray/Good	0.1
13	Corridor/Day Rm.	Wood	Wall	Light Gray/Good	0.0
14	Bunker	Drywall	Wall Board	Yellow/Good	0.1
15	"	Wood	Baseboard	"	0.0
16	Restroom	Sheetrock	Wall	"	0.0
17	"	Wood	Door Facing	Light Gray/Good	0.0
18	"	Sheetrock	Wall	Yellow/Good	0.1
19	"	Wood	Door	Light Gray/Fair	0.1
20	"	Wood	Door Jam (south)	Light Gray/Good	1.5
21	"	Wood	Door Jam (east)	Light Gray/Good	2.0
22	"	Sheetrock	Closet	Light Gray	0.0
23	"	Wood	Baseboard	Light Gray	0.0
24	Vehicle Bay	Wood	Wall (8 ft.)	Light Gray	0.1
25	"	Wood	Wall (4 ft.)	Light Gray	0.1
26	"	Wood	Door to Restroom	Light Gray	0.0
27	Storage	Wood	Wall Post	Light Gray/Poor	6.2
28	"	Wood	Stairway Landing	Light Gray	0.1
29	"	Wood	Stairway Rail	Light Gray	0.0
30	Storage 2 nd floor	Wood	Wall	Light Gray/Poor	2.9
31	Vehicle Bay	Wood	Wall (9 ft.)	Light Gray/Good	2.7
32	"	Wood	Wall (4 ft.)	Light Gray/Good	0.2
33	"	Wood	Wall (9 ft.)	Light Gray/Good	0.7
34	Ext. Office	Wood	Door	Brown/Fair	0.0
35	Ext.	Aluminum	Siding	Yellow	0.3
36	Vehicle Bay	Cement	Floor Stripe	Yellow	2.2
37	SCBA Storage	Wood	Window Casing	Light Gray/Good	0.6
38	Ext. Door	Wood	Door	Brown/Good	0.1

----- End of Readings -----

Remarks: 1. Use LPA-1 Calibration Block
2. Reading #27, 9 feet of winscot has no paint

ENVIRONMENTAL TESTING & CONSULTING, INC.

2924 Walnut Grove Road - Memphis, TN 38111 - (901)327-2750

INORGANIC ANALYSIS DATA SHEET

Client Name **Quest Micro Analytics, Inc.**
2530 Electronic Lane, Ste 712
Dallas, TX 75220-1229

Project #
FID #

Site ID USACE

Date Arrived 04/28/99
ETC Order Number 9904759

ETC Lab ID 9904759-01

Sample ID: 90050-L01

Matrix :SOLID

Sample Date :04/27/99

WHOLE BLDG. MAT'L COMPOSITE SAMPLE

TEST	RESULT UNITS: (mg/L)	DL	DATE EXTRACTED	DATE ANALYZED	BY	METHOD
TCLP Extraction	Leachate		04/29/99		TL	1311
Lead - TCLP	0.622	0.315		05/06/99	TD	6010B

DL - Detection Limit


LABORATORY MANAGER

ENVIRONMENTAL TESTING & CONSULTING, INC.

2924 Walnut Grove Road - Memphis, TN 38111 - (901)327-2750

INORGANIC ANALYSIS DATA SHEET

Client Name **Quest Micro Analytics, Inc.**
2530 Electronic Lane, Ste 712
Dallas, TX 75220-1229

Project #
FID #

Site ID USACE

Date Arrived 04/28/99
ETC Order Number 9904759

ETC Lab ID 9904759-02
Sample ID: 90050-L02

Matrix :SOLID
Sample Date :04/27/99

BROWN PAINT (SOFFIT)

TEST	RESULT UNITS: (mg/L)	DL	DATE EXTRACTED	DATE ANALYZED	BY	METHOD
TCLP Extraction	Leachate		04/29/99		TL	1311
Lead - TCLP	12.5	0.315		05/06/99	TD	6010B

DL - Detection Limit


LABORATORY MANAGER

**2530 Electronic Lane, Suite 712
Dallas, Texas 75220-1229
Tel. 214.351.4441
Fax 214.351.4487**

CHAIN OF CUSTODY RECORD

9901759

[illegible]



ENVIRONMENTAL TESTING & CONSULTING, INC.

2924 Walnut Grove Road • Memphis, TN 38111 • (901) 327-2750 • FAX (901) 327-6334

Founded 1972

May 7, 1999

Ms. Jennifer Jaber
Quest Micro Analytics, Inc.
2530 Electronic Lane, Ste 712
Dallas, TX 75220-1229


Ref: Analytical Testing
ETC Order # 9904759
Project Description USACE

The above referenced project has been analyzed per your instructions. The analyses were performed in our laboratory in accordance with Standard Methods 17th/18th Edition; The Solid Waste Manual SW-846; EPA Methods for the Analysis of Water and Wastes and/or 40 CFR part 136.

The results are shown on the attached analysis sheet(s).

Please do not hesitate to contact our office if you have any questions.

Sincerely,


Nathan A. Pera, IV
Chief Executive Officer

rt
Attachment

QUEST

Certifications

Tennessee #TN02027
Arkansas
Alabama #40730
Kentucky #90047
North Carolina #415
South Carolina #84002002

Mississippi
Oklahoma #9311
Virginia #00106
Washington #C248
US Army Corps of Engineers

BID OPTION NO. 2

REPORT OF LEAD PAINT INSPECTION FOR BUILDING 90049 (CONTROL TOWER AND OPS BUILDING)

Inspection Date: 01/04/00
 Report Date: 1/6/00
 Abatement Level: 1.0
 Report No. 01/04/00 10:04
 Total Readings: 135 (Partial)
 Job Started: 01/04/00 10:04
 Job Finished: 01/05/00 13:42
 Instrument: X-Ray Fluorescent Analyzer (RMD's LPA-1)

READ NO.	LOCATION	SUBSTRATE/STRUCTURE	PAINT COLOR	Lead mg/cm ²
1	CALIBRATION			0.9 Std
2	CALIBRATION			0.9 Std
3	CALIBRATION			0.8 Std
4	WOOD BLOCK			-0.1 Std
5	WOOD BLOCK			-0.1 QM
6	WOOD BLOCK			-0.1 QM
7	BASEMENT	CONCRETE/WINDOW SILL	BEIGE	-0.1 QM
8	BASEMENT	WOOD/DOOR FRAME	BEIGE	1.0 QM
9	BASEMENT	WOOD/DOUBLE DOOR	BEIGE	-0.1 QM
10	BASEMENT	CONCRETE/FLOOR	GRAY	-0.2 QM
11	BASEMENT	WOOD/DOOR FRAME	BEIGE	0.5 QM
12	BASEMENT	WOOD/DOOR	BEIGE	0.0 QM
13	BASEMENT	CONCRETE/WALL	BEIGE	-0.1 QM
14	BASEMENT	CONCRETE/WALL	BEIGE	0.0 QM
15	BASEMENT HALLWAY	STUCCO/WALL	BEIGE	0.3 QM
16	BASEMENT HALLWAY	WOOD/DOUBLE DOOR	BEIGE	-0.1 QM
17	BASEMENT/RESTROOM	STUCCO/WALL	YELLOW	0.1 QM
18	BASEMENT/RESTROOM	CEILING/STUCCO	YELLOW	0.1 QM
19	BASEMENT/HALLWAY	STUCCO/BASEMENT	BEIGE	0.0 QM
20	BASEMENT/HALLWAY	METAL/DOOR	BEIGE	0.0 QM
21	BASEMENT/HALLWAY	WOOD/DOOR FRAME	BEIGE	0.4 QM
22	BASEMENT/ROOM	CONCRETE/WALL	BEIGE	0.5 QM
23	BASEMENT/ROOM	WOOD/DOOR FRAME	GREEN	0.4 QM
24	BASEMENT/ROOM	CONCRETE/WALL	WHITE	0.1 QM
25	BASEMENT/HALLWAY	WOOD/DOOR	BEIGE	-0.1 QM
26	BASEMENT/HALLWAY	WOOD/BASEBOARD	BEIGE	0.0 QM
27	BASEMENT/HALLWAY	WOOD/DOOR FRAME (L01)	BEIGE	0.6 QM
28	1ST FLOOR	WOOD/PANEL	BROWN	-0.1 QM
29	BASEMENT/ROOM	SHEETROCK/WALL	BEIGE	0.0 QM
30	1ST FLOOR	WOOD/BASEBOARD ON STAIR	BEIGE	0.1 QM
31	STAIRWAY	WOOD/WALL TRIM	BEIGE	0.2 QM
32	STAIRWAY	SHEETROCK/CEILING	BEIGE	-0.1 QM
33	RESTAURANT	SHEETROCK/WALL	GRAY	0.1 QM
34	RESTAURANT	WOOD/DOOR	GRAY	0.0 QM
35	RESTAURANT	WOOD/DOOR FRAME	GRAY	0.0 QM
36	RESTAURANT	WOOD/BASEBOARD	GRAY	0.1 QM
37	RESTROOM 1ST FLOOR	SHEETROCK/WALL	WHITE	-0.1 QM
38	VIP ROOM	WOOD PANEL/WALL	BROWN	-0.1 QM
39	2ND FLOOR	WOOD/WINDOW SILL	BROWN	0.0 QM
40	2ND FLOOR	WOOD/PANEL/WALL	BROWN	0.0 QM
41	2ND FLOOR	WOOD/DOOR FRAME	BROWN	0.0 QM
42	2ND FLOOR	WOOD/WINDOW SILL	BROWN	0.0 QM
43	2ND FLOOR	WOOD PANEL/WALL	BROWN	-0.1 QM
44	2ND FLOOR	WOOD PANEL/COLUMN	BROWN	0.1 QM
45	2ND FLOOR RESTROOM	WOOD/WINDOW LEDGE	BEIGE	-0.1 QM
46	2ND FLOOR CLOSET	SHEETROCK/WALL	BEIGE	0.1 QM
47	2ND FLOOR OFFICE	WOOD PANEL/WALL	BROWN	0.0 QM
48	2ND FLOOR OFFICE	WOOD/ WINDOW SILL	BROWN	0.0 QM
49	2ND FLOOR OFFICE	SHEETROCK/CEILING	WHITE	0.0 QM

50	2ND FLOOR OFFICE	WOOD/DOOR FRAME	BROWN	-0.1	QM
51	2ND FLOOR MECH ROOM	SHEETROCK/WALL	WHITE	0.1	QM
52	2ND FLOOR MECH ROOM	SHEETROCK/WALL	GREEN	-0.1	QM
53	2ND FLOOR MECH ROOM	WOOD/BASEBOARD	BLACK	0.1	QM
54	2ND FLOOR OFFICE	WOOD PANEL/WALL	BROWN	-0.1	QM
55	EXTERIOR OVER 1ST FL	METAL SIDING/WALL	TAN	0.1	QM
56	EXTERIOR OVER 1ST FL	METAL/WINDOW FRAME	BROWN	-0.1	QM
57	STAIRWAY 2ND	STUCCO/WALL	BLUE	0.0	QM
58	STAIRWAY 2ND	STUCCO/WALL	WHITE	0.1	QM
59	STAIRWAY 2ND	WOOD/BASEBOARD	BLACK	0.0	QM
60	STAIRWAY 2ND	METAL/IBeam	BLACK	2.5	QM
61	STAIRWAY 2ND	METAL/RISER	BLACK	2.3	QM
62	STAIRWAY 2ND	METAL/TREAD	BLACK	0.4	QM
63	STAIRWAY ON 2ND	WOOD/DOOR	BROWN	0.0	QM
64	STAIRWAY ON 2ND	WOOD/DOOR STOP	BROWN	0.0	QM
65	EXTERIOR	METAL/FACIAL ON PORCH	BROWN	0.0	QM
66	EXTERIOR	CONCRETE/SUPPORT COLUMN	BROWN	-0.1	QM
67	EXTERIOR	METAL SIDING/WALL	BEIGE	0.1	QM
68	EXTERIOR	METAL/WINDOW FACING	BROWN	0.0	QM
69	EXTERIOR	METAL SIDING/WALL	BEIGE	0.1	QM
70	EXTERIOR	METAL/BASE FACING	BROWN	0.0	QM
71	EXTERIOR BASEMENT	METAL/WINDOW FRAME	BROWN	8.2	QM
72	EXTERIOR BASEMENT	WOOD/DOOR	BROWN	-0.1	QM
73	EXTERIOR BASEMENT	WOOD/DOOR FRAME	BROWN	0.0	QM
74	EXTERIOR BASEMENT	METAL/HANDRAIL	BROWN	2.2	QM
75	EXTERIOR	METAL SIDING/WALL	BEIGE	0.2	QM
76	EXTERIOR	WOOD/SCREEN DOOR	BROWN	0.0	QM
77	EXTERIOR	METAL/WINDOW CASING	BROWN	0.0	QM
78	EXTERIOR TOWER	METAL/WALL	BEIGE	7.4	QM
79	CALIBRATION			1.0	QM
80	CALIBRATION			1.0	QM
81	CALIBRATION			1.0	QM
82	WOOD BLOCK			-0.1	QM
83	WOOD BLOCK			0.0	QM
84	WOOD BLOCK			-0.1	QM
85	CALIBRATION			1.0	QM
86	CALIBRATION			1.0	QM
87	CALIBRATION			0.7	QM
88	WOOD BLOCK			-0.1	QM
89	WOOD BLOCK			0.0	QM
90	WOOD BLOCK			0.1	QM
91	3RD FLOOR	STUCCO/WALL	GRAY	-0.1	QM
92	3RD FLOOR	WOOD/DOOR	BEIGE	0.0	QM
93	3RD FLOOR	STUCCO/WALL	GREEN	0.1	QM
94	3RD FLOOR	WOOD/DOOR JAMB	WHITE	0.0	QM
95	3RD FLOOR	STUCCO/CEILING	WHITE	-0.1	QM
96	3RD FLOOR	SHEETROCK/WINDOW END	WHITE	0.0	QM
97	3RD FLOOR	WOOD/BASEBOARD	WHITE	0.0	QM
98	4TH FLOOR	WOOD/WINDOW SILL	GRAY	0.0	QM
99	4TH FLOOR	STEEL/WINDOW FRAME	GRAY	0.0	QM
100	4TH FLOOR	METAL/DOOR JAMB	GREEN	0.0	QM
101	4TH FLOOR	STUCCO/WALL	GREEN	-0.1	QM
102	5TH FLOOR	METAL/DOOR JAMB	BLUE	0.0	QM
103	5TH FLOOR	WOOD/DOOR JAMB	GREEN	-0.1	QM
104	5TH FLOOR	WOOD/BASEBOARD	BLACK	0.0	QM
105	5TH FLOOR	WOOD PANEL/WALL	GREEN	-0.1	QM
106	5TH FLOOR	WOOD/DOOR	GREEN	3.4	QM
107	5TH FLOOR	WOOD/DOOR	BLUE	-0.1	QM
108	5TH FLOOR STAIRWAY	STUCCO/WALL	WHITE	-0.1	QM
109	5TH FLOOR	WOOD/DOOR	BLACK	3.0	QM
110	5TH FLOOR	WOOD/DOOR	WHITE	-0.1	QM
111	5TH FLOOR	WOOD/DOOR CASING	BLACK	0.1	QM
112	5TH FLOOR STAIRWAY	METAL/HEATER	BLUE	0.0	QM

113	5TH FLOOR	SHEETROCK/WALL	WHITE	-0.1	QM
114	6TH FLOOR	STUCCO/WALL	GREEN	0.1	QM
115	6TH FLOOR	WOOD/DOOR	GREEN	0.0	QM
116	6TH FLOOR	SHEETROCK/WALL	GREEN	-0.1	QM
117	6TH FLOOR	STUCCO/CEILING	WHITE	0.0	QM
118	7TH FLOOR	STUCCO/WALL	WHITE	0.0	QM
119	7TH FLOOR	STEEL/IBeam	WHITE	1.0	QM
120	7TH FLOOR	STEEL/UTILITY DOOR	BROWN	1.0	QM
121	7TH FLOOR	WOOD/DOOR	BLUE/GRAY	0.0	QM
122	7TH FLOOR	METAL/DOOR CASING	BLUE	0.0	QM
123	7TH FLOOR RESTROOM	WOOD/DOOR	BLUE	-0.1	QM
124	7TH FLOOR RESTROOM	STUCCO/WALL	BLUE	-0.1	QM
125	7TH FLOOR STAIRWAY	STEEL BEAM/LADDER	BLACK	2.0	QM
126	CONTROL TOWER	METAL/WINDOW SILL	BLACK	0.0	QM
127	CONTROL TOWER	METAL/SUPPORT BEAM	BLACK	0.1	QM
128	CONTROL TOWER EXT.	METAL SIDING/WALL	BEIGE	5.5	QM
129	CONTROL TOWER EXT.	STEEL/DECK	BROWN	0.2	QM
130	CONTROL TOWER	WOOD/SUPPORT WINDOW SILL	BLACK	-0.1	QM
131	CALIBRATION			1.0	QM
132	CALIBRATION			1.0	QM
133	CALIBRATION			1.0	QM
134	WOOD BLOCK			-0.2	QM
135	WOOD BLOCK			0.0	QM

---- End of Readings ----

ENVIRONMENTAL TESTING & CONSULTING, INC.
2924 Walnut Grove Road - Memphis, TN 38111 - (901)327-2750
INORGANIC ANALYSIS DATA SHEET

Client Name Quest Micro Analytics, Inc.

Project #

2530 Electronic Lane, Ste 712
Dallas, TX 75220-1229

Site ID Fort Hood

Date Arrived 01/10/00
ETC Order Number 0001160

ETC Lab ID 0001160-01
Sample ID: 90049-L01

Matrix :SOLID
Sample Date :01/05/00

TEST	RESULT	UNITS	DETECTION LIMIT	TIME ANALYZED	DATE ANALYZED BY	METHOD
Lead	2,110	mg/Kg	10.0	1600	01/11/00 JF	7420

M

CHAIN OF CUSTODY¹ RECORD

Site/Feature: Ft. Hood

FIDEX Acct. No.: 1128-3856-2

Proj/Instal'n: Fixed Wing Aircraft
Park, Bldg. 90049
Electronic Data Format: Use.pdf

Lab. PR & C No.: % 93190877
Proj Mngr: Poy Har Kathleen Wu
Phone No: 817/978-3977 ext 1645

Turn-around Time in Days

Turn-around Time	Analytes/Test Methods
3-5	EPA 600/R-93/116

3-5
PL 114 Point Count! EPA 600/R-93/116

Total Lead (mg/Kg) EPA 6010

TCI Prod (Env) EPA 1311/6010 10

NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable

[illegible]

Date/Time: 1/7/20 10:40

Date/Time:

Date/Time:

Received by: _____

Received by:

Received for lab by:

Date/Time: 01-06-2007 1300

100

1000

STORING DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

I-V-DI FORM SEP 97



ENVIRONMENTAL TESTING & CONSULTING, INC.
2924 Walnut Grove Road • Memphis, TN 38111 • (901) 327-2750 • FAX (901) 327-6331

Founded 1972

January 12, 2000

Ms. Jennifer Jaber
Quest Micro Analytics, Inc.
2530 Electronic Lane, Ste 712
Dallas, TX 75220-1229

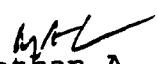
Ref: Analytical Testing
ETC Order # 0001160
Project Description Fort Hood

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with Standard Methods 17th/18th Edition; The Solid Waste Manual SW-846; EPA Methods for the Analysis of Water and Wastes and/or 40 CFR part 136.

The results are shown on the attached analysis sheet(s).

Please do not hesitate to contact our office if you have any questions.

Sincerely,


Nathan A. Pera, IV
Chief Executive Officer

rt
Attachment

QUEST

Certifications

Tennessee	#TN02027
Arkansas	
Alabama	#40730
Kentucky	#90047
North Carolina	#415
South Carolina	#84002002

Mississippi	
Oklahoma	#9311
Virginia	#00106
Washington	#C248
US Army Corps of Engineers	

SECTION 02111

EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL

09/01

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2000) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 5434	(1997) Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 302	Designation, Reportable Quantities, and Notification
29 CFR 1926	Safety and Health Regulations for Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	U.S. Army Corps of Engineers Safety and Health Requirements Manual
------------	--------------------------------------------------------------------

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Surveys; G

Separate cross-sections of each area before and after excavation and after backfilling.

SD-03 Product Data

Excavation and Handling Work Plan; G

Work Plan within 30 calendar days after notice to proceed. No work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved. The Contractor shall allow 30 calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, the Work Plan shall include:

- a. Schedule of activities.
- b. Method of excavation and equipment to be used.
- c. Shoring or side-wall slopes proposed.
- d. Dewatering plan.
- e. Storage methods and locations for liquid and solid contaminated material.
- f. Borrow sources and haul routes.
- g. Decontamination procedures.
- h. Spill contingency plan.

Closure Report; G

2 copies of the Closure Report within 14 calendar days of work completion at the site.

SD-06 Test Reports

Backfill; G
Surveys; G
Confirmation Sampling and Analysis; G
Sampling of Stored Material; G
Sampling Liquid; G
Compaction; G

Test results.

1.3 SURVEYS

Surveys shall be performed immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Surveys shall also be performed immediately after backfill of each excavation. The Contractor shall provide cross-sections on 7.6 meter intervals and at break points for all excavated areas. Locations of confirmation samples shall also be surveyed and shown on the drawings.

1.4 REGULATORY REQUIREMENTS

1.4.1 Permits and Licenses

The Contractor shall obtain required federal, state, and local permits for excavation and storage of contaminated material. Permits shall be obtained at no additional cost to the Government.

1.4.2 Air Emissions

Air emissions shall be monitored and controlled in accordance with Section 01355.

1.5 DESCRIPTION OF WORK

The work shall consist of excavation and temporary storage of approximately 300 cubic meters of contaminated material. Approximate locations of contaminated material are shown on the drawings. The Contracting Officer shall be notified within 24 hours, and before excavation, if contaminated material is discovered that has not been previously identified or if other discrepancies between data provided and actual field conditions are discovered.

1.6 CHEMICAL TESTING

Required sampling and chemical analysis shall be conducted in accordance with Section 01450 CHEMICAL DATA QUALITY CONTROL.

1.7 SCHEDULING

The Contractor shall notify the Contracting Officer 30 calendar days prior to the start of excavation of contaminated material. The Contractor shall be responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

PART 2 PRODUCTS

2.1 BACKFILL

Backfill material shall be obtained from the location indicated on the drawings. Backfill shall be classified in accordance with ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH and shall be free from roots and other organic matter, trash, debris, snow, ice or frozen materials. Backfill material shall be tested for the parameters listed below at a frequency of once per 3000 cubic meters. A minimum of one set of classification tests shall be performed per borrow source.

2.2 SPILL RESPONSE MATERIALS

The Contractor shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall

be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

PART 3 EXECUTION

3.1 EXISTING STRUCTURES AND UTILITIES

No excavation shall be performed until site utilities have been field located. The Contractor shall take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost to the Government. Utilities encountered that were not previously shown or otherwise located shall not be disturbed without approval from the Contracting Officer.

3.2 CLEARING

Clearing shall be performed to the limits shown on the drawings in accordance with Section 02231 CLEARING AND GRUBBING.

3.3 CONTAMINATED MATERIAL REMOVAL

3.3.1 Excavation

Areas of contamination shall be excavated to the depth and extent shown on the drawings and not more than 60 mm beyond the depth and extent shown on the drawings unless directed by the Contracting Officer. Excavation shall be performed in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. An excavation log describing visible signs of contamination encountered shall be maintained for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D 5434.

3.3.2 Shoring

If workers must enter the excavation, it shall be evaluated, shored, sloped or braced as required by EM 385-1-1 and 29 CFR 1926 section 650.

3.3.3 Dewatering

Surface water shall be diverted to prevent entry into the excavation. No dewatering shall be performed without prior approval of the Contracting Officer.

3.4 CONFIRMATION SAMPLING AND ANALYSIS

The Contracting Officer shall be present to inspect the removal of contaminated material from each site. After all material suspected of being contaminated has been removed, the excavation shall be examined for evidence of contamination. If the excavation appears to be free of contamination, field analysis shall be used to determine the presence of contamination using a real time vapor monitoring instrument or immunoassay field kits. Excavation of additional material shall be as directed by the Contracting Officer. After all suspected contaminated material is removed, confirmation samples shall be collected and analyzed.

Samples shall be collected at a frequency of one per 100 square meters from the bottom or as directed by the Contracting Officer. A minimum of one sample shall be collected from the bottom of the excavation. Based on test results, the Contractor shall propose any additional excavation which may be required to remove material which is contaminated above action levels. Additional excavation shall be subject to approval by the Contracting Officer. Locations of samples shall be marked in the field and documented on the as-built drawings.

3.5 CONTAMINATED MATERIAL STORAGE

Material shall be placed in temporary storage immediately after excavation. The following paragraphs describe acceptable methods of material storage. Storage units shall be in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the source of contaminated material in each temporary storage unit.

3.5.1 Stockpiles

Stockpiles shall be constructed to isolate stored contaminated material from the environment. The maximum stockpile size shall be 300 cubic meters. Stockpiles shall be constructed to include:

- a. A chemically resistant geomembrane liner free of holes and other damage. Non-reinforced geomembrane liners shall have a minimum thickness of 0.5 mm. Scrim reinforced geomembrane liners shall have a minimum weight of 20 kg/100 square meters. The ground surface on which the geomembrane is to be placed shall be free of rocks greater than 12 mm in diameter and any other object which could damage the membrane.
- b. Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Non-reinforced geomembrane covers shall have a minimum thickness of 0.25 mm. Scrim reinforced geomembrane covers shall have a minimum weight of 13 kg/100 square meters. The cover material shall be extended over the berms and anchored or ballasted to prevent it from being removed or damaged by wind.
- c. Berms surrounding the stockpile, a minimum of 300 mm in height. Vehicle access points shall also be bermed.
- d. The liner system shall be sloped to allow collection of leachate. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.

3.5.2 Roll-Off Units

Roll-off units used to temporarily store contaminated material shall be water tight. A cover shall be placed over the units to prevent precipitation from contacting the stored material. The units shall be located on a nearby paved surface. Liquid which collects inside the units shall be removed and stored in accordance with paragraph Liquid Storage.

3.5.3 Liquid Storage

Liquid collected from excavations and stockpiles shall be temporarily stored in 220 L barrels. Liquid storage containers shall be water-tight and shall be located at a secure location.

3.6 SAMPLING

3.6.1 Sampling of Stored Material

Samples of stored material shall be collected at a frequency of once per 100 cubic meters. Samples shall be tested.

Stored material with contaminant levels that exceed the action levels shall be treated offsite. Analyses for contaminated material to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analyses to the extent required by the approved offsite treatment, storage or disposal (TSD) facility shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government

3.6.2 Sampling Liquid

Liquid collected from excavations shall be sampled at a frequency of once for every 2,000 L of liquid collected. Samples shall be tested.

Liquid with contaminant levels that exceed action levels shall be treated offsite. Analyses for contaminated liquid to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analysis to the extent required by the approved offsite treatment, storage or disposal (TSD) facility receiving the material shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.6.3 Sampling Beneath Storage Units

Samples from beneath each storage unit shall be collected prior to construction of and after removal of the storage unit. Samples shall be collected at a frequency of one per each 100 square meters from a depth interval of 0 to 0.15 m and shall be tested.

Based on test results, soil which has become contaminated above action levels shall be removed at no additional cost to the Government. Contaminated material which is removed from beneath the storage unit shall be handled in accordance with paragraph Sampling of Stored Material. As directed by the Contracting Officer and at no additional cost to the Government, additional sampling and testing shall be performed to verify areas of contamination found beneath stockpiles have been cleaned up to below action levels.

3.7 SPILLS

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Contracting Officer immediately. If the spill exceeds the reporting threshold, the Contractor shall follow the pre-established procedures as described in the RCRA Contingency Plan for immediate reporting and containment. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. As directed by the Contracting Officer, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Government.

3.8 BACKFILLING

3.8.1 Confirmation Test Results

Excavations shall be backfilled immediately after all contaminated materials have been removed and confirmation test results have been approved. Backfill shall be placed and compacted to the lines and grades shown on the drawings.

3.8.2 Compaction

Approved backfill shall be placed in lifts with a maximum loose thickness of 200 mm. Soil shall be compacted to 90 percent of ASTM D 1557 maximum dry density. Density tests shall be performed at a frequency of once per 930 square meters per lift. A minimum of one density test shall be performed on each lift of backfill placed. Field in-place dry density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. If ASTM D 2922 is used, a minimum of one in ten tests shall be checked using ASTM D 1556 or ASTM D 2167. Test results from ASTM D 1556 or ASTM D 2167 shall govern if there is a discrepancy with the ASTM D 2922 test results.

3.9 DISPOSAL REQUIREMENTS

Offsite disposal of contaminated material shall be in accordance with Section 02120 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.

3.10 CLOSURE REPORT

2 copies of a Closure Report shall be prepared and submitted within 14 calendar days of completing work at the site. The report shall be labeled with the contract number, project name, location, date, name of general

contractor, and the Corps of Engineers District contracting for the work. The Closure Report shall include the following information as a minimum:

a. A cover letter signed by a responsible company official certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.

b. A narrative report including, but not limited to, the following:

(1) site conditions, ground water elevation, and cleanup criteria;

(2) excavation logs;

(3) field screening readings;

(4) quantity of materials removed from each area of contamination;

(5) quantity of water/product removed during dewatering;

(6) sampling locations and sampling methods;

(7) sample collection data such as time of collection and method of preservation;

(8) sample chain-of-custody forms; and

(9) source of backfill.

c. Copies of all chemical and physical test results.

d. Copies of all manifests and land disposal restriction notifications.

e. Copies of all certifications of final disposal signed by the responsible disposal facility official.

f. Waste profile sheets.

g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 15 m of excavation, sample locations, and sample identification numbers. On-site stockpile, storage, treatment, loading, and disposal areas shall also be shown on the drawings.

h. Progress Photographs. Color photographs shall be used to document progress of the work. A minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions shall be taken before work begins. After work has been started, activities at each work location shall be photographically recorded daily. Photographs shall be a minimum of 76.2 x 127.0 mm and shall include:

(1) Soil removal and sampling.

(2) Dewatering operations.

(3) Unanticipated events such as spills and the discovery of additional contaminated material.

(4) Contaminated material/water storage, handling, treatment, and transport.

(5) Site or task-specific employee respiratory and personal protection.

(6) Fill placement and grading.

(7) Post-construction photographs. After completion of work at each site, the Contractor shall take a minimum of four views of each excavation site.

A digital version of all photos shown in the report shall be included with the Closure Report. Photographs shall be a minimum of 76mm by 127 mm and shall be mounted back-to-back in double face plastic sleeves punched to fit standard three ring binders. Each print shall have an information box attached. The box shall be typewritten and arranged as follows:

Project Name:	Direction of View:
Location:	Date/Time:
Photograph No.:	Description of View:

-- End of Section --

SECTION 02120A

TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS

10/96

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 107	Hazardous Materials Program Procedures

49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

On-site Hazardous Waste Management; G

Prior to start of work, a plan detailing the manner in which hazardous wastes shall be managed.

Notices of Non-Compliance and Notices of Violation

Notices of non-compliance or notices of violation by a Federal, state, or local regulatory agency issued to the Contractor in relation to any work performed under this contract. The Contractor shall immediately provide copies of such notices to the Contracting Officer. The Contractor shall also furnish all relevant documents regarding the incident and any information requested by the Contracting Officer, and shall coordinate its response to the notice with the Contracting Officer or his designated representative prior to submission to the notifying authority. The Contractor shall also furnish a copy to the Contracting Officer of all documents submitted to the regulatory authority, including the final reply to the notice, and all other materials, until the matter is resolved.

SD-06 Test Reports

Recordkeeping; G

Information necessary to file state annual or EPA biennial reports for all hazardous waste transported, treated, stored, or disposed of under this contract. The Contractor shall not forward these data directly to the regulatory agency but to the Contracting Officer at the specified time. The submittal shall contain all the information necessary for filing of the formal reports in the form and format required by the governing Federal or state regulatory agency. A cover letter shall accompany the data to include the contract number, Contractor name, and project location.

Spill Response

In the event of a spill or release of a hazardous substance (as

designated in 40 CFR 302), or pollutant or contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Contracting Officer immediately. If the spill exceeds a reporting threshold, the Contractor shall follow the pre-established procedures for immediate reporting to the Contracting Officer.

Exception Reports; G

In the event that a manifest copy documenting receipt of hazardous waste at the treatment, storage, and disposal facility is not received within 35 days of shipment initiation, the Contractor shall prepare and submit an exception report to the Contracting Officer within 37 days of shipment initiation.

SD-07 Certificates

Qualifications

Copies of the current certificates of registration issued to the Contractor and/or subcontractors or written statements certifying exemption from these requirements.

EPA Off-Site Policy

A letter certifying that EPA considers the facilities to be used for all off-site disposal to be acceptable in accordance with the Off-Site policy in 40 CFR 300, Section .440. This certification shall be provided for wastes from Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6901 et seq., sites as well as from Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq., responses. See Attachment A, sample certification, at the end of this section.

Management Plan

Certificates documenting the ultimate disposal of hazardous wastes, polychlorinated biphenyls (PCBs), and/or asbestos within 180 days of initial shipment. Receipt of these certificates will be required for final payment.

Shipping Documents and Packagings Certification; G

All transportation related shipping documents to the Contracting Officer, including draft hazardous waste manifests, draft land disposal restriction notifications, draft asbestos waste shipment records, draft manifests for PCBs, draft bill of lading for hazardous materials, lists of corresponding proposed labels, packages, marks, and placards to be used for shipment, waste profiles, and supporting waste analysis documents, for review a minimum of 14 days prior to anticipated pickup. Packaging assurances shall be furnished prior to transporting hazardous material; "generator copies" of hazardous waste manifests, land disposal restriction notifications, asbestos waste shipment records, "generator copies" of manifests used for initiating shipments of PCBs, used oil invoices/shipment records, bill of lading, and supporting waste analysis documents shall be furnished when shipments are originated; and "receipt copies" of asbestos waste shipment records at the designated disposal facility shall be

furnished not later than 35 days after acceptance of the shipment.

1.3 QUALIFICATIONS

1.3.1 Transportation and Disposal Coordinator

The Contractor shall designate, by position and title, one person to act as the Transportation and Disposal Coordinator (TDC) for this contract. The TDC shall serve as the single point of contact for all environmental regulatory matters and shall have overall responsibility for total environmental compliance at the site including, but not limited to, accurate identification and classification of hazardous waste and hazardous materials; determination of proper shipping names; identification of marking, labeling, packaging and placarding requirements; completion of waste profiles, hazardous waste manifests, asbestos waste shipment records, PCB manifests, bill of lading, exception and discrepancy reports; and all other environmental documentation. The TDC shall have, at a minimum, one year of specialized experience in the management and transportation of hazardous waste.

1.3.2 Training

The Contractor's hazardous materials employees shall be trained, tested, and certified to safely and effectively carry out their assigned duties in accordance with Section 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST). The Contractor's employees transporting hazardous materials or preparing hazardous materials for transportation shall be trained, tested, and certified in accordance with 49 CFR 172.

1.3.3 Certification

The Contractor and/or subcontractors transporting hazardous materials shall possess a current certificate of registration issued by the Research and Special Programs Administration (RSPA), U.S. Department of Transportation, when required by 49 CFR 107, Subpart G.

1.4 LAWS AND REGULATIONS REQUIREMENTS

Work shall meet or exceed the minimum requirements established by Federal, state, and local laws and regulations which are applicable. These requirements are amended frequently and the Contractor shall be responsible for complying with amendments as they become effective. In the event that compliance exceeds the scope of work or conflicts with specific requirements of the contract, the Contractor shall notify the Contracting Officer immediately.

1.5 DEFINITIONS

- a. Hazardous Material. A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated pursuant to the Hazardous Materials Transportation Act, 49 U.S.C. Appendix Section 1801 et seq. The term includes materials designated as hazardous materials under the provisions of 49 CFR 172, Sections .101 and .102 and materials which meet the defining criteria for hazard classes and divisions in 49 CFR 173. EPA designated hazardous wastes are also hazardous materials.

- b. Hazardous Waste. A waste which meets criteria established in RCRA or specified by the EPA in 40 CFR 261 or which has been designated as hazardous by a RCRA authorized state program.

PART 2 PRODUCTS

2.1 MATERIALS

The Contractor shall provide all of the materials required for the packaging, labeling, marking, placarding and transportation of hazardous wastes and hazardous materials in conformance with Department of Transportation standards. Details in this specification shall not be construed as establishing the limits of the Contractor's responsibility.

2.1.1 Packagings

The Contractor shall provide bulk and non-bulk containers for packaging hazardous materials/wastes consistent with the authorizations referenced in the Hazardous Materials Table in 49 CFR 172, Section .101, Column 8. Bulk and non-bulk packaging shall meet the corresponding specifications in 49 CFR 173 referenced in the Hazardous Materials Table, 49 CFR 172, Section .101.

Each packaging shall conform to the general packaging requirements of Subpart B of 49 CFR 173, to the requirements of 49 CFR 178 at the specified packing group performance level, to the requirements of special provisions of column 7 of the Hazardous Materials Table in 49 CFR 172, Section .101, and shall be compatible with the material to be packaged as required by 40 CFR 262. The Contractor shall also provide other packaging related materials such as materials used to cushion or fill voids in overpacked containers, etc. Sorbent materials shall not be capable of reacting dangerously with, being decomposed by, or being ignited by the hazardous materials being packaged. Additionally, sorbents used to treat free liquids to be disposed of in landfills shall be non-biodegradable as specified in 40 CFR 264, Section .314.

2.1.2 Markings

The Contractor shall provide markings for each hazardous material/waste package, freight container, and transport vehicle consistent with the requirements of 49 CFR 172, Subpart D and 40 CFR 262, Section .32 (for hazardous waste), 40 CFR 761, Section .45 (for PCBs), and 40 CFR 61, Section .149(d) (for asbestos). Markings shall be capable of withstanding, without deterioration or substantial color change, a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation.

2.1.3 Labeling

The Contractor shall provide primary and subsidiary labels for hazardous materials/wastes consistent with the requirements in the Hazardous Materials Table in 49 CFR 172, Section .101, Column 6. Labels shall meet design specifications required by 49 CFR 172, Subpart E including size, shape, color, printing, and symbol requirements. Labels shall be durable and weather resistant and capable of withstanding, without deterioration or substantial color change, a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation.

2.1.4 Placards

For each off-site shipment of hazardous material/waste, the Contractor

shall provide primary and subsidiary placards consistent with the requirements of 49 CFR 172, Subpart F. Placards shall be provided for each side and each end of bulk packaging, freight containers, transport vehicles, and rail cars requiring such placarding. Placards may be plastic, metal, or other material capable of withstanding, without deterioration, a 30 day exposure to open weather conditions and shall meet design requirements specified in 49 CFR 172, Subpart F.

2.1.5 Spill Response Materials

The Contractor shall provide spill response materials including, but not limited to, containers, adsorbent, shovels, and personal protective equipment. Spill response materials shall be available at all times in which hazardous materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of material being handled.

2.2 EQUIPMENT AND TOOLS

The Contractor shall provide miscellaneous equipment and tools necessary to handle hazardous materials and hazardous wastes in a safe and environmentally sound manner.

PART 3 EXECUTION

3.1 ON-SITE HAZARDOUS WASTE MANAGEMENT

These paragraphs apply to Government owned waste only. Contractors are prohibited by 10 U.S.C. 2692 from storing contractor owned waste on site for any length of time. The Contractor shall be responsible for ensuring compliance with all Federal, state, and local hazardous waste laws and regulations and shall verify those requirements when preparing reports, waste shipment records, hazardous waste manifests, or other documents. The Contractor shall identify hazardous wastes using criteria set forth in 40 CFR 261 or all applicable state and local laws, regulations, and ordinances. When accumulating hazardous waste on-site, the Contractor shall comply with generator requirements in 40 CFR 262 and any applicable state or local law or regulations. On-site accumulation times shall be restricted to applicable time frames referenced in 40 CFR 262, Section .34 and any applicable state or local law or regulation. Accumulation start dates shall commence when waste is first generated (i.e. containerized or otherwise collected for discard). The Contractor shall only use containers in good condition and compatible with the waste to be stored. The Contractor shall be responsible for ensuring containers are closed except when adding or removing waste. The Contractor shall be responsible for immediately marking all hazardous waste containers with the words "hazardous waste" and other information required by 40 CFR 262, Section .32 and any applicable state or local law or regulation as soon as the waste is containerized. An additional marking shall be placed on containers of "unknowns" designating the date sampled, and the suspected hazard. The Contractor shall be responsible for inspecting containers for signs of deterioration and shall be responsible for responding to any spills or leaks. The Contractor shall inspect all hazardous waste areas weekly and shall provide written documentation of the inspection. Inspection logs shall contain date and time of inspection, name of individual conducting the inspection, problems noted, and corrective actions taken.

3.1.1 Hazardous Waste Classification

The Contractor, in consultation with the Contracting Officer, shall identify all waste codes applicable to each hazardous waste stream based on requirements in 40 CFR 261 or any applicable state or local law or regulation. The Contractor shall also identify all applicable treatment standards in 40 CFR 268 and state land disposal restrictions and shall make a determination as to whether or not the waste meets or exceeds the standards. Waste profiles, analyses, classification and treatment standards information shall be submitted to Contracting Officer for review and approval.

3.1.2 Management Plan

The Contractor shall prepare a plan detailing the manner in which hazardous wastes will be managed and describing the types and volumes of hazardous wastes anticipated to be managed as well as the management practices to be utilized. The plan shall identify the method to be used to ensure accurate piece counts and/or weights of shipments; shall identify waste minimization methods; shall propose facilities to be utilized for treatment, storage, and/or disposal; shall identify areas on-site where hazardous wastes are to be handled; shall identify whether transfer facilities are to be utilized; and if so, how the wastes will be tracked to ultimate disposal.

3.2 OFF-SITE HAZARDOUS WASTE MANAGEMENT

The Contractor shall use RCRA Subtitle C permitted facilities which meet the requirements of 40 CFR 264 or facilities operating under interim status which meet the requirements of 40 CFR 265. Off-site treatment, storage, and/or disposal facilities with significant RCRA violations or compliance problems (such as facilities known to be releasing hazardous constituents into ground water, surface water, soil, or air) shall not be used.

3.2.1 Description of TSD Facility and Transporter

The Contractor shall provide the Contracting Officer with EPA ID numbers, names, locations, and telephone numbers of TSD facilities and transporters. This information shall be contained in the Hazardous Waste Management Plan for approval prior to waste disposal.

3.2.2 Status of the Facility

Facilities receiving hazardous waste must be permitted in accordance with 40 CFR 270 or operating under interim status in accordance with 40 CFR 265 requirements, or must be permitted by an authorized state program. Additionally, prior to using a TSD Facility, the Contractor shall contact the EPA Regional Off-site Coordinator specified in 40 CFR 300, Section .440, to determine the facility's status, and document all information necessary to satisfy the requirements of the EPA Off-Site policy and furnish this information to the Contracting Officer.

3.2.3 Shipping Documents and Packagings Certification

Prior to shipment of any hazardous material off-site, the Contractor's TDC shall provide written certification to the Contracting Officer that hazardous materials have been properly packaged, labeled, and marked in accordance with Department of Transportation and EPA requirements.

3.2.4 Transportation

The Contractor shall use manifests for transporting hazardous wastes as

required by 40 CFR 263 or any applicable state or local law or regulation. Transportation shall comply with all requirements in the Department of Transportation referenced regulations in the 49 CFR series. The Contractor shall acquire manifests in accordance with the hierarchy established in 40 CFR 262, Section .21. The Contractor shall prepare hazardous waste manifests for each shipment of hazardous waste shipped off-site. Manifests shall be completed using instructions in 40 CFR 262, Subpart B and any applicable state or local law or regulation. Manifests and waste profiles shall be submitted to Contracting Officer for review and approval. The Contractor shall prepare land disposal restriction notifications as required by 40 CFR 268 or any applicable state or local law or regulation for each shipment of hazardous waste. Notifications shall be submitted with the manifest to the Contracting Officer for review and approval. When the additional cost of sending a qualified USACE representative to a remote location for a small clean up project is unwarranted, the option of requiring the on-site Contractor to sign the manifests on behalf of the generator is permitted and should be considered. This option shall only be exercised on a project specific basis, if prior to the solicitation process, written authorization of the customer and approval of the Chief, Construction Division at the executing district has been obtained, and the technical provisions of the contract solicitation provide competing contractors notice of the requirement.

3.2.5 Treatment and Disposal of Hazardous Wastes

The hazardous waste shall be transported to an approved hazardous waste treatment, storage, or disposal facility within 90 days of the accumulation start date on each container. The Contractor shall ship hazardous wastes only to facilities which are properly permitted to accept the hazardous waste or operating under interim status. The Contractor shall ensure wastes are treated to meet land disposal treatment standards in 40 CFR 268 prior to land disposal. The Contractor shall propose TSD facilities via submission of the Hazardous Waste Management Plan, subject to the approval of the Contracting Officer.

3.3 HAZARDOUS MATERIALS MANAGEMENT

The Contractor, in consultation with the Contracting Officer, shall evaluate, prior to shipment of any material off-site, whether the material is regulated as a hazardous waste in addition to being regulated as a hazardous material; this shall be done for the purpose of determining proper shipping descriptions, marking requirements, etc., as described below.

3.3.1 Identification of Proper Shipping Names

The Contractor shall use 49 CFR 172, Section .101 to identify proper shipping names for each hazardous material (including hazardous wastes) to be shipped off-site. Proper shipping names shall be submitted to the Contracting Officer in the form of draft shipping documents for review and approval.

3.3.2 Packaging, Labeling, and Marking

The Contractor shall package, label, and mark hazardous materials/wastes using the specified materials and in accordance with the referenced authorizations. The Contractor shall mark each container of hazardous waste of 418 L or less with the following:

"HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal.
If found, contact the nearest police or public safety authority or the U.S.
Environmental Protection Agency.
Generator's name _____
Manifest Document Number _____".

3.3.3 Shipping Documents

The Contractor shall ensure that each shipment of hazardous material sent off-site is accompanied by properly completed shipping documents.

3.3.3.1 PCB Waste Shipment Documents

The Contractor shall prepare hazardous waste manifests for each shipment of PCB waste shipped off-site. Manifests shall be completed using instructions in 40 CFR 761, Sections .207 and .208 and all other applicable requirements. Documents shall be submitted to Contracting Officer for review and approval.

3.3.3.2 Asbestos Waste Shipment Documents

The Contractor shall prepare waste shipment records as required by 40 CFR 61 for shipments of asbestos. Waste shipment records shall be submitted to the Contracting Officer for review and approval. Waste shipment records shall be signed by the Contractor.

3.3.3.3 Other Hazardous Material Shipment Documents

The Contractor shall prepare a bill of lading for each shipment of hazardous material which is not accompanied by a hazardous waste manifest or asbestos waste shipment record which fulfills the shipping paper requirements. The bill of lading shall satisfy the requirements of 49 CFR 172, Subpart C, and any applicable state or local law or regulation, and shall be submitted to the Contracting Officer for review and approval. For laboratory samples and treatability study samples, the Contractor shall prepare bills of lading and other documentation as necessary to satisfy conditions of the sample exclusions in 40 CFR 261, Section .4(d) and (e) and any applicable state or local law or regulation. Bill of lading requiring shipper's certifications shall be signed by the Contractor.

3.4 OBTAINING EPA ID NUMBERS

The Contractor shall complete EPA Form 8700-12, Notification of Hazardous Waste Activity, and submit to the Contracting Officer for review and approval. The Contractor shall allow a minimum of 30 days for processing the application and assigning the EPA ID number. Shipment shall be made not earlier than one week after receipt of the EPA ID number.

3.5 SPECIAL REQUIREMENTS FOR ASBESTOS WASTES

If work involves asbestos containing wastes, the Contractor shall manage these wastes in accordance with specification Section 02111.

3.6 WASTE MINIMIZATION

The Contractor shall minimize the generation of hazardous waste to the maximum extent practicable. The Contractor shall take all necessary precautions to avoid mixing clean and contaminated wastes. The Contractor shall identify and evaluate recycling and reclamation options as

alternatives to land disposal. Requirements of 40 CFR 266 shall apply to: hazardous wastes recycled in a manner constituting disposal; hazardous waste burned for energy recovery; lead-acid battery recycling; and hazardous wastes with economically recoverable precious metals.

3.7 RECORDKEEPING

The Contractor shall be responsible for maintaining adequate records to support information provided to the Contracting Officer regarding exception reports, annual reports, and biennial reports. The Contractor shall be responsible for maintaining asbestos waste shipment records for a minimum of 3 years from the date of shipment or any longer period required by any applicable law or regulation or any other provision of this contract.

3.8 SPILL RESPONSE

The Contractor shall respond to any spill of hazardous material or hazardous waste which are in the custody or care of the Contractor, pursuant to this contract. Any direction from the Contracting Officer concerning a spill or release shall not be considered a change under the contract. The Contractor shall comply with all applicable requirements of Federal, state, or local laws or regulations regarding any spill incident.

3.9 EMERGENCY CONTACTS

The Contractor shall be responsible for complying with the emergency contact provisions in 49 CFR 172, Section .604. Whenever the Contractor ships hazardous materials, the Contractor shall provide a 24 hr emergency response contact and phone number of a person knowledgeable about the hazardous materials being shipped and who has comprehensive emergency response and incident mitigation information for that material, or has immediate access to a person who possesses such knowledge and information. The phone must be monitored on a 24 hour basis at all times when the hazardous materials are in transportation, including during storage incidental to transportation. The Contractor shall ensure that information regarding this emergency contact and phone number are placed on all hazardous material shipping documents. The Contractor shall designate an emergency coordinator and post the following information at areas in which hazardous wastes are managed:

- a. The name of the emergency coordinator.
- b. Phone number through which the emergency coordinator can be contacted on a 24 hour basis.
- c. The telephone number of the local fire department.
- d. The location of fire extinguishers and spill control materials.

Attachment A
SAMPLE OFF-SITE POLICY CERTIFICATION MEMO

Project/Contract #: _____
Waste Stream: _____
Primary TSD Facility, EPA ID # and Location: _____
Alter. TSD Facility, EPA ID # and Location: _____

EPA Region	Primary Contact	Secondary Contact
-----	-----	-----
I	(617) 565-9446	(617) 573-1754
II	(212) 637-4139	(212) 264-2638
III	(814) 566-3450	(215) 597-8338
IV	(404) 562-8589	(404) 347-7603
V	(312) 886-3587	(312) 886-4445
VI	(214) 665-2282	(214) 655-2281
VII	(913) 551-7883	(913) 551-7667
VIII	(303) 312-6419	(303) 293-1506
IX	(415) 744-2091	(415) 744-2114
X	(206) 553-1061	(206) 553-1061

EPA representative contacted: _____
EPA representative phone number: _____
Date contacted: _____

Comment: _____
The above EPA representative was contacted on _____. As of that date
the above sites were considered acceptable in accordance with the Off-Site
Policy in 40 CFR 300.440.

Signature: _____ Date: _____
Phone number: _____

-- End of Section --

SECTION 02220

DEMOLITION

05/02

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6 (1990) Safety Requirements for Demolition Operations

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline K (1997) Containers for Recovered Fluorocarbon Refrigerants

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61-SUBPART M National Emission Standard for Asbestos

40 CFR 82 Protection of Stratospheric Ozone; Refrigerant Recycling

49 CFR 173.301 Shipment of Compressed Gas Cylinders

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (June 2000) Storage and Handling of Liquefied and Compressed Gases and Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M Requisitioning and Issue Procedures

MIL-STD-129 (Rev. N) Marking for Shipment and Storage

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified

by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible (in accordance with Section 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT, if applicable; salvaged items and materials shall be disposed of as specified.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Notification to TDH; G

Notification of building demolition activity, signed by the Contractor, shall be provided to the Texas Department of Health (TDH) no later than 10 days before demolition of any structure. The Contractor shall submit a receipt of proof of notification to the Contracting Officer.

SD-03 Product Data

Work Plan; G,

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with EM 385-1-1. Perform an asbestos inspection and report the results to the installation representative prior to demolition activities.

SD-07 Certificates

Demolition plan; G

Notifications; G

Notification of Demolition and Renovation forms; G

Submit proposed demolition and removal procedures to the Contracting Officer for approval before work is started.

SD-11 Closeout Submittals

Receipts

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform with ANSI A10.6.

1.4.1 Notifications

Furnish timely notification of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61-SUBPART M. Notify the Regional Office of the United States Environmental Protection Agency (USEPA) State's environmental protection agency local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61-SUBPART M.

Complete and submit Notification of Demolition and Renovation forms to Federal and State authorities and Contracting Officer, postmarked or delivered at least ten working days prior to commencement of work, in accordance with 40 CFR 61-SUBPART M. Complete paragraphs I, II, III.B, III.C (if applicable), VIII, and IX thru XIX of form. Copy of form is attached at end of this section.

1.4.2 Receipts

Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris to occupied portions of the building on airfield pavements and avoid the creation of a nuisance or hazard in the surrounding area. Apply water during removal of asbestos-laden materials as required to control the spread of dust and debris. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where aircraft safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by jet or prop blast. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Work

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this

contract. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.6.3 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent displacement.

1.6.4 Trees

Trees within the project site which might be damaged during demolition, and which are indicated to be left in place, shall be protected by a 1.8 m high fence. The fence shall be securely erected a minimum of 1.5 m from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

1.6.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.6.6 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area. All personnel shall wear appropriate masks, eye and body protection for protection against falling debris and hazardous materials.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.8 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste

material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. The barricade shall consist of a fence covered with a fabric designed to stop the spread of debris; anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Contracting Officer.

1.10 Required Data

Demolition plan shall include procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and airfield lighting, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Include statements affirming Contractor inspection of the existing roof deck and its suitability to perform as a safe working platform or if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the work.

1.11 Environmental Protection

The work shall comply with the requirements of Section 01355 ENVIRONMENTAL PROTECTION.

1.12 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.13 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the following schedule:

- a. Bldg #90050 is available for demolition 60 days after contract notice to proceed is signed by the Contractor.
- b. Bldg #90049 shall be available for demolition 60 days after government acceptance of the new Base Operations Building.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Structures

[AM#2]All structure indicated to be removed in their entirety and completely. See notes on Demolition Plans for special removal items and procedures.

[AM#2] _____

3.1.2 Utilities and Related Equipment

Remove existing utilities , as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer. If utility lines are encountered that are not shown on drawings, contact the Contracting Officer for further instructions.

3.1.3 Paving and Slabs

Remove sawcut concrete and asphaltic concrete paving and slabs as indicated to a depth of 50 mm below new finish grade. Provide neat sawcuts at limits of pavement removal as indicated.

3.1.4 Roofing

[AM#2]Remove existing roof panels and associated components and trim in their entirety down to existing purlins on the existing Pallet Warehouse Building (Bldg #90080) and replace with new decking and standing seam metal roofing system as detailed on the drawings and the approved SSMR shop drawings. [AM#2] _____ Sequence work to minimize building exposure between demolition and new roof materials installation. Install temporary roofing and flashing as necessary to maintain a watertight condition throughout the course of the work. Remove temporary work prior to installation of permanent roof system materials unless approved otherwise by the Contracting Officer. If the existing deck and support structure are deteriorated, such that ability to support foot traffic and construction loads is unknown then make provisions for worker safety during demolition and installation of new materials as described in paragraphs entitled "Statements" and "Regulatory and Safety Requirements." Sequence the work to minimize hazard to workers. Identify all asbestos-laden materials prior to demolition activities and dispose of per work plan approved by the

installation representative.

3.1.4.1 Reroofing

When removing the existing roofing system from the roof deck, remove only as much roofing as can be recovered by the end of the work day, unless approved otherwise by the Contracting Officer. No opening in the roof cover shall be attempted in threatening weather and any opening made shall be resealed prior to suspension of work the same day.

3.1.5 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain and to facilitate the installation of new work. Where new masonry adjoins existing, the new work shall abut or tie into the existing construction as indicated.

3.1.6 Concrete

Saw concrete along straight lines to a depth of not less than 50 mm. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.

3.1.7 Airfield Lighting

Remove existing airfield lighting as indicated and terminate in a manner satisfactory to the Contracting Officer. Remove edge lights, as indicated and deliver to a location on the station in accordance with instructions of the Contracting Officer.

3.1.8 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

- a. Holes and depressions caused by previous physical damage or left as a result of removals in existing masonry walls to remain shall be completely filled with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.
- b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.
- c. Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.1.9 Air Conditioning Equipment

Remove air conditioning equipment without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990. Recover all refrigerants prior to removing air conditioning equipment and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)." Turn in salvaged Class I ODS refrigerants as specified in paragraph, "Salvaged Materials and Equipment."

3.1.10 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.11 Locksets on Swinging Doors

The Contractor shall remove all locksets from all swinging doors indicated to be removed and disposed of. Contractor shall give the locksets to the Contracting Officer after their removal.

3.2 FILLING

Holes, open basements and other hazardous openings shall be filled in accordance with Section 2300A Earthwork.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.3.2 Reuse of Materials and Equipment

No materials or equipment will be re-used.

3.3.3 Salvaged Materials and Equipment

Contractor shall salvage items and material to the maximum extent possible.

Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items.

Containers shall be properly identified as to contents.

Historical items shall be removed in a manner to prevent damage. The following historical items shall be delivered to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.

3.3.4 Debris Disposal in the Ft. Hood Area

Landfill coupons, that permit waste disposal at the Ft. Hood Landfill free of charge, are available from the Contracting Officer. The coupons will be issued only upon the submission of a written request, by the prime contractor to the ROICC, which must identify the nature of the waste and the number of coupons requested. The landfill coupons issued under this contract are to be used only for the disposal of waste generated by this contract. If the prime contractor, one of its subcontractors, or one of its waste haulers is found to be misusing the landfill coupons by disposing of waste not generated under this contract, all rights under the contract to use landfill coupons shall be forfeited, from the date of misuse forward. All unused coupons will be returned to the Contracting Officer and no additional coupons will be issued for the duration of the contract. The Contracting Officer's refusal to issue landfill coupons, because of prior misuse, is not a change to the contract and no adjustment of the contract price will be made.

3.3.5 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting ARI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.

3.3.5.1 Special Instructions

Each container shall have in it no more than one type of ODS. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained
- d. Date of shipment

3.3.5.2 Fire Suppression Containers

Fire suppression system cylinders and canisters with electrical charges or initiators shall be deactivated prior to shipment. Also, safety caps shall be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.3.6 Transportation Guidance

Shipment of all ODS containers shall be in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, 49 CFR 173.301, and DOD 4000.25-1-M.

3.3.7 Unsalvageable Material

The Fort hood Landfill may be used to dispose of Class 2 waste and non-friable asbestos (category 1. and 2.). Friable asbestos, light bulbs, mercury switches, thermostats, valances, and power poles containing cerosoak shall be treated as hazardous material, and shall not be disposed of in the Ft. Hood Landfill. Metal can not be disposed of in the Ft. Hood Landfill. Broken up asphalt, concrete and masonry (containing no exposed feinforcing steel), and other noncombustible material, except concrete permitted to remain in place, shall be disposed of after completely separating from other material in the disposal area located at the inert materials pile next to the Ft. Hood Landfill, as shown on the project location map and on the drawings. All items to be demolished, which can not be diposposed of in the Ft. Hood Landfill shall be disposed of off government controlled property, at the expense and responsibility of the contractor. See Specification 01368 fo Ft. Hood Landfill requirements and procedures.

3.4 CLEANUP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

3.4.1 Debris and Rubbish

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

-- End of Section --

SECTION 02300A

EARTHWORK

12/97

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1140	(1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(1990; R 1996el) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SC, CL, and CH, . Satisfactory materials for grading shall be comprised of stones less than 75 mm , except for fill material for pavements and railroads which shall be comprised of stones less than 75 mm in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plastic index of 0. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 Method C abbreviated as a percent of laboratory maximum density.

1.2.5 Topsoil

Material suitable for topsoils obtained from offsite areas and excavations .

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Earthwork; G

Procedure and location for disposal of unused satisfactory material. Blasting plan when blasting is permitted. Proposed source of borrow material.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

SD-06 Test Reports

Testing; G

Within 24 hours of conclusion of physical tests, 3 copies of test results, including calibration curves and results of calibration tests.

SD-07 Certificates

Testing; G

Qualifications of the commercial testing laboratory or Contractor's testing

facilities.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings . The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at Fort Worth District Office, Corps of Engineers. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5.1 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation.

1.6 BLASTING

Blasting will not be permitted.

1.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 150 millimeters. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 50 mm in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.2 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas.

During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 1 meter from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties.

Unless specifically provided, no borrow shall be obtained within the

limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

The Contractor shall notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

3.6 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR FILL OR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR FILL OR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02630 STORM-DRAINAGE SYSTEM; and Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.7 PREPARATION OF GROUND SURFACE FOR FILL OR EMBANKMENTS

3.7.1 General Requirements

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 150 [AM#2] mm; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of fill or embankment materials to assure adequate bond between fill or embankment material and the prepared ground surface.

3.7.2 Frozen Material

Embankment shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Contracting Officer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompacted to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Embankment material shall not contain frozen clumps of soil, snow, or ice.

3.8 FILLS OR EMBANKMENTS

3.8.1 Earth Fills or Embankments

Earth fills or embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm. The material shall be placed in successive horizontal layers of loose material not more than 150 millimeters in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth fill or embankments forming raw subgrade for pavements shall be identical with those requirements specified in paragraph RAW SUBGRADE PREPARATION. Compaction shall be accomplished by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9 RAW SUBGRADE PREPARATION

3.9.1 Construction

Raw Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 150 mm below finished grade for the raw subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire raw subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the raw subgrade for roadways shall not show deviations greater than 13 millimeter when tested with a 3.6 meter straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish raw subgrade shall not

vary more than 15 mm from the established grade and cross section.

3.9.2 Compaction

Compaction shall be accomplished by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, each layer of the embankment shall be compacted to at least 90 percent of laboratory maximum density.

3.9.2.1 Raw Subgrade for Pavements

Raw subgrade for pavements shall be compacted to at least 90 percentage laboratory maximum density for the depth below the surface of the pavement shown.

3.9.2.2 Raw Subgrade for Shoulders

Raw Subgrade for shoulders shall be compacted to at least 90 percentage laboratory maximum density for the depth below the surface of shoulder shown

3.10 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph RAW SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.11 FINISHING

The surface of excavations, fills, embankments, and raw subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 30 mm of the grades and elevations indicated except that the degree of finish for raw subgrades shall be specified in paragraph RAW SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

3.12 TESTING

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. All testing for density shall be performed by NICET

Level I soils technicians. Field in-place density shall be determined in accordance with ASTM D 1556 ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompact to meet specification requirements. Tests on recompact areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.12.1 Fill and Backfill Material Gradation

One test per 1500 cubic meters stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136, ASTM D 422, and ASTM D 1140.

3.12.2 In-Place Densities

- a. One test per 1600 square meters, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per 100 square meters, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
- c. One test per 30 linear meters, or fraction thereof, of each lift of fill, embankment or backfill for roads .

3.12.3 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

- a. One check test per lift for each 8300 square meters, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each 500 square meters, of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each 150 linear meters, or fraction thereof, of fill, embankment or backfill for roads .

3.12.4 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable

weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.12.5 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 1500 cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.12.6 Tolerance Tests for Raw Subgrades

Continuous checks on the degree of finish specified in paragraph RAW SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.13 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

-- End of Section --

SECTION 02315A

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

08/98

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2216	(1998) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, abbreviated as percent laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Testing; G

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP. Nonexpansive fill shall have a PI less than 12. Select fill shall have a PI less than 20.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75 mm. The Contracting Officer shall be notified of any contaminated materials.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic.

2.1.4 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 20 when tested in accordance with ASTM D 4318.

2.1.5 [AM#2] 2.1.5 Non-Expansive Soils

Non-expansive soils shall conform to TxDOT (Texas Department of Transportation) Item 247 Type A Grade 1, or select materials.

2.1.6 [AM#2] 2.1.6 Select Materials

Select materials are defined as soils that have a plasticity index less than 25 when tested in accordance with ASTM D 4318.

2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 37.5 mm and no more than 2 percent by weight shall pass the 4.75 mm size sieve.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

The areas within lines 1.5 m outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction

operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of outside the limits of Government-controlled property at the Contractor's responsibility.

3.2 TOPSOIL

Topsoil shall be stripped to a depth of 150 millimeters below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified, and shall include trenching for utility and foundation drainage systems to a point 1.5 m beyond the building line of each building and structure, and all work incidental thereof. Excavation shall extend a distance of 5 feet from perimeter of walls and footings. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be replaced with satisfactory material; and payment will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced, at no additional cost to the Government, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.4.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 900 mm of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is

open, the water level shall be maintained continuously, at least 1 meter below the working level.

3.5 SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

3.7 BLASTING

Blasting will not be permitted.

3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 150 mm below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph FILLING AND BACKFILLING.

3.9 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained as specified in Section 02300 EARTHWORK.

3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02300 EARTHWORK.

3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas

shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 150 mm before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

3.13 FILLING AND BACKFILLING

A minimum of 1 meter of compacted non-expansive fill shall be placed under all slabs on grade. On the Base Operations Building, at least 3 feet of existing soil shall be removed prior to backfilling. In-place soils under existing pavement may qualify as non-expansive fill. Testing of pavement subcourse for adequacy is the responsibility of the Contractor. Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm in loose thickness, or 150 mm when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade and shall include backfill for outside grease interceptors and underground fuel tanks. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm above sewer lines and 300 mm above other utility lines shall be free from stones larger than 25 mm in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 100 mm in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recomposition over underground utilities and heating lines shall be by hand tamping.

3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 2922. When ASTM D 2922 is used, check tests shall be performed in accordance with ASTM D 1556. The check tests shall be made at the beginning of each different type of material encountered and at the intervals directed by the Contracting Officer. Technicians shall be NICET Level I soils certified.

3.14.1 In-Place Densities

In-place density and moisture content test results shall be included with the Contractor's daily construction quality control reports.

3.14.1.1 In-Place Density of Subgrades

One test per 105 square meters or fraction thereof.

3.14.1.2 In-Place Density of Fills and Backfills

One test per 185 square meters or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than 3 meters in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 10 square meters, or one test for each 30 linear meters of long narrow fills 20 meters or more in length.

3.14.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

3.14.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material, including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 100 cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

3.15 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.16 GRADING

Areas within 1.5 m outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of

trash and debris until final inspection has been completed and the work has been accepted.

3.17 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 50 mm by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 1.46 kN/m to 2.34 kN/m of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.18 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

[AM#2] 3.19 DELETED

-- End of Section --

SECTION 02316A

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

05/02

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.2 DEGREE OF COMPACTION

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 Method C.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Field Density Tests; ,
Testing of Backfill Materials; ,

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SC, and CL .

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75 mm. The Contracting Officer shall be notified of any contaminated materials.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials shall include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

2.1.4 Rock

Rock shall consist of boulders measuring 1/2 cubic meter or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures, exceeding 1/2 cubic meter in volume, except that pavements shall not be considered as rock.

2.1.5 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 75 millimeters in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.6 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

2.1.7 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a 0.075 mm mesh sieve and no less than 95 percent by weight passing the 25 mm sieve. The maximum allowable aggregate size shall be 75 millimeters, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

2.1.8 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory

materials free from rocks 25 millimeters or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 25 millimeters in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

2.2 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 152 mm wide with minimum thickness of 0.102 mm. Tape shall have a minimum strength of 12.1 MPa lengthwise and 10.3 MPa crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 1 meter deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

2.3 Detection Wire For Non-Metalic Piping

Detection wire shall be insulated single strand, solid copper with a minimum diameter of 12 AWG.

PART 3 EXECUTION

3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 600 mm. Excavated material not required or not satisfactory for backfill shall be removed from the site.

Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

3.1.1 Trench Excavation Requirements

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation

manual is available, trench walls shall be made vertical. Trench walls more than 1.5 meters high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 1.5 meters high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 600 mm plus pipe outside diameter (O.D.) for pipes of less than 600 mm inside diameter and shall not exceed 900 mm plus pipe outside diameter for sizes larger than 600 mm inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 75 millimeters or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed 100 millimeters below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.1.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.1.1.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be sufficient to leave at least 300 mm clear between the outer structure surfaces and the face of the excavation or support members. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.1.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion

of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.1.2 Stockpiles

Stockpiles of satisfactory and unsatisfactory shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Contracting Officer.

3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 150 mm loose thickness for compaction by hand operated machine compactors, and 200 mm loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 600 mm above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.

3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

3.2.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm loose thickness.

3.2.1.3 Bedding and Initial Backfill

Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. Maximum rock size for backfill shall be 25 mm. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways,

railroads and airfields, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

- a. Roadways, Railroads, and Airfields: Backfill shall be placed up to the elevation at which the requirements in Section 02300 EARTHWORK control. Water flooding or jetting methods of compaction will not be permitted.
- b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 300 mm loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.2.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 3 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress. Only cohesive materials may be used for backfill around manholes. Density tests shall be performed once per each compacted 150 mm lift.

3.3 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.3.1 Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 450 mm of cover in rock excavation and not less than 600 mm of cover in other excavation. Trenches shall be graded as specified for pipe-laying requirements in Section 02556 GAS DISTRIBUTION SYSTEM.

3.3.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 1.2 meters from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.3.3 Heat Distribution System

Initial backfill material shall be free of stones larger than 6.3 mm in any dimension.

3.3.4 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 600 mm from the finished grade, unless otherwise indicated.

3.3.5 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 450 millimeters below finished grade unless otherwise shown.

3.4 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.4.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer.

3.4.2 Testing of Backfill Materials

Classification of backfill materials shall be determined in accordance with ASTM D 2487 and the moisture-density relations of soils shall be determined in accordance with ASTM D 1557. A minimum of one soil classification and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

3.4.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 30 meters of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic meters of material used. Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

3.4.4 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to 600 [AM#2] mm above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 900 mm (36 inches) shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

-- End of Section --

SECTION 02466

DRILLED FOUNDATION CAISSONS (PIERS)

Amendments #0001 & #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 615 (1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Drilled Foundation Caissons;

A certified copy of the survey. Lines and levels shall be established and caisson centerline locations staked and maintained by a registered surveyor provided by the Contractor.

Qualifications;

Qualifications of the Foundation System Contractor shall show that he has been engaged in the successful installation of drilled foundation caissons for at least 5 years.

SD-02 Shop Drawings

Drilled Foundation Caissons;

Detailed records in an approved form, for each caisson, showing shaft diameters, depths of test holes, top and bottom elevations, bearing strata description, casing description, water conditions, concrete strength, concrete volume, rock elevations, dates of excavation and concrete placement, and other pertinent information. Upon completion of caisson work, the Contractor shall provide a record of centerline locations based on the survey of the registered surveyor provided by the Contractor. In addition, corrective measures shall be similarly recorded. A complete tabulation of all records pertaining to approved caissons shall be delivered to the Contracting Officer.

1.3 QUALIFICATIONS

The work shall be performed by a specialty Contractor, specializing in the specified foundation system and having experience installing the specified foundation system under similar subsurface conditions.

1.4 SUBSURFACE DATA

Subsurface soil data logs are shown on the drawings. The subsurface investigation report of materials, as taken from subsurface investigations, are available for examination at the Fort Worth District Office.

1.5 MEASUREMENT AND PAYMENT

1.5.1 Drilled Piers

Drilled foundation piers will be measured by the linear foot for depth actually drilled in strict conformance to the requirements of the specifications and drawings. The length of drilled piers will be measured from the authorized bottom of the piers to their upper termination at the bottom of the grade beam, slab, pier cap, or any formed portion of the pier above grade, as applicable. Payment for drilled foundation piers will be made at the applicable contract unit price per linear foot according to diameter. This payment shall constitute full compensation for all plant, labor, materials, and all costs necessary for drilling, temporary and permanent casing, (Am#2)

and furnishing and placing steel and concrete, complete.

1.5.2 **1.4.3 Temporary Casing that Cannot be Removed (Am#2)**

Payment for temporary casing that cannot be removed will be measured by the linear foot from the very lowest point where originally installed to the upper termination of the casing. Payment for casing will be made at the applicable contract unit price per linear foot according to diameter for only the material cost of the casing. (Am#2)

1.6 SUPERVISION, INSPECTION, AND SAFETY

1.6.1 Contractor Supervision

The Contractor shall provide for the supervision of all phases of drilled pier construction. Supervision shall be the Contractor's responsibility as outlined in Quality Control provisions of Section 01451 CONTRACTOR QUALITY CONTROL. Each drilled pier excavation shall be checked by the Contractor for its depth, water removal, cleanup, workmanship, and for all tolerance requirements before any concrete is placed.

1.6.2 Government Inspection

The Contracting Officer reserves the right to inspect each drilled pier excavation prior to placement of reinforcing steel and concrete. The Contractor shall furnish the Contracting Officer all necessary equipment required for proper inspection of drilled pier excavations. This inspection in no way relieves the Contractor of his responsibilities as outlined in CONTRACT CLAUSE "INSPECTION OF CONSTRUCTION."

1.6.3 Safety Precautions for Workmen and Inspectors

The Contractor shall provide and operate all equipment required by the Contracting Officer to allow visual inspection of pier excavations by workmen or the Government, including equipment for personnel entering the excavation. Sufficient approved equipment shall be maintained to raise and lower Contractor and Government personnel into the excavation whenever required. All such equipment and all procedures used for personnel entering pier excavations shall strictly comply with all requirements of the applicable safety manuals.

1.6.3.1 Life Line

Each person entering a drilled pier excavation shall be provided with a life line rigged so that the person can be immediately hoisted out of the excavation in an emergency. The life line shall be suitable for instant rescue, securely fastened to a shoulder harness, and separated from any line used to remove excavated materials. No person shall be lowered into a drilled pier excavation prior to casing the shaft through the overburden.

1.6.3.2 Ventilation

Each drilled pier excavation shall be provided with a ventilating device of sufficient capacity to assure a safe and healthy atmosphere before workmen and inspectors are permitted to enter the drilled pier excavation and during all work periods.

PART 2 PRODUCTS

2.1 CONCRETE WORK

Concrete work shall be in accordance with requirements of Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE, as modified herein:

2.1.1 Coarse Aggregate

Maximum size of coarse aggregate shall be 3/4 inch.

2.1.2 Reinforcing Steel

Reinforcing steel shall conform to ASTM A 615 Grade 60. Steel shall be tied into cages and inserted securely in the caissons, in position and alignment, as shown, prior to concrete placement.

2.1.3 Strength

Concrete strength shall be 3000 psi at 28 days. Slump shall be not less than 5 inches nor more than 7 inches. Air content shall be 3-5%.

PART 3 EXECUTION

3.1 PREPARATION

- a. Excavation of piers or groups of piers shall be performed so that the excavation and the placement of reinforcing steel and concrete are a continuous operation performed the same day that the excavation is started. Excavations shall not be left open overnight. Casings shall be on site prior to starting the drilling operation. Drilled piers shall be excavated to the depths and dimensions shown in the drawings. The bottoms of the pier excavation shall be cleaned of loose and disturbed materials or materials determined to be unsatisfactory for the required bearing pressure. Excavated material shall be disposed of in accordance with Section 02315A - EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS. Excavations below indicated depths, without specific direction by the Contracting officer, shall be filled with concrete at no cost to the Government. Where, in the opinion of the Contracting Officer, materials are encountered at the indicated depths that do not provide the required bearing capacity or would result in unsatisfactory construction, the excavation shall be extended as directed by the Contracting Officer. Payment for the additional excavation and pier construction will be in accordance with PART 1 paragraph MEASUREMENT AND PAYMENT.
- b. The drilling equipment shall be of suitable type and of sufficient size and capacity to satisfactorily perform the required drilling operations as specified or indicated. All equipment shall be subject to specific approval by the Contracting Officer and shall have a minimum torque of 50,000 foot pounds and a minimum crowd of 30,000 foot pounds. Any equipment which fails to perform satisfactorily shall be immediately modified as approved or removed and replaced.

3.2 INSTALLATION

- a. During construction, the pier excavation shall be adequately and securely protected against cave-ins, displacement of the surrounding earth, and inflow of ground and surface water by means of temporary steel casings as required or as directed by the Contracting Officer. Casings shall have outside diameters not less than indicated shaft sizes, and shall be capable of sustaining loads imposed by installing, sealing, maintaining the excavated hole, and extracting. Casings shall be on site prior to starting the drilling operation. The casing shall have a minimum wall thickness of 1/4 inch. The ends of the casing shall not be damaged such that proper seating and sealing are impaired. Damaged casing shall be immediately repaired or removed from the site. Temporary steel casings shall be withdrawn, as the concrete is being placed, maintaining sufficient head of concrete within the casing to offset water table and to prevent extraneous material from falling in from the sides or entering from beneath casing and mixing with concrete. Casings may be jerked upward a maximum of 4 inches to break the bottom seal but shall thereafter be removed with a smooth, continuous motion. All voids surrounding the casing shall be filled with concrete extruded from the bottom of the casing as it is being raised, with all free water surrounding the casing being forced to the surface ahead of the rising concrete. Venting shall be provided if necessary to insure removal of water around the casing as the concrete level rises, and the casing is being removed. Driving of casings shall not be permitted within 20 feet of concrete placed within the preceding 3 days.
- b. The inside of steel casings shall be thoroughly cleaned before being placed in a pier hole.
- c. Pier holes shall be protected from inflow of ground or surface water. Water that flows into the excavations shall be continuously removed and the maximum permissible depth of water in the bottom of excavation will be 2 inches at the start of concrete placement. In the event that excessive water enters the hold, the excavation shall be deepened to undisturbed material immediately prior to concrete placement.
- d. Concrete shall be placed in the pier hole within three hours after approval of the completed excavation. Concrete shall be continuously placed by methods that insure against segregation and dislodging of excavation sidewalls and shall completely fill the bell and shaft. Concrete shall be placed by pumps, tremie, or drop chutes. The discharge of pumping chute shall be kept a minimum of 3 feet below the fresh concrete surface during placement.
- e. Concrete shall be vibrated for not less than the upper 5 feet of pier.
- f. Protection shall be provided around the top of the excavation to prevent debris and water from entering the excavation and concrete placed therein.

3.3 TOLERANCES

- a. Any pier out of center or plumb beyond the tolerance specified shall be corrected as necessary to comply with the tolerances and the Contractor shall bear any cost of correction. Method of correction shall be approved by the Contracting Officer
- b. Cross sections of shafts shall not be less than design dimensions. Cross sections of shafts shall not be greater than design dimensions plus 3 inches unless approved or directed by the Contracting Officer.
- c. Location of the tops of installed piers shall not deviate from the centerline locations shown on the drawings more than 3 inches.
- d. Vertical caissons shall be installed plumb within a maximum of 1-1/2 inches 1-1/2 inches for the first 10 feet 10 feet and within 1/2 inch 1/2 inch for each 10 feet 10 feet of additional depth.
- e. The center of the pier will be established after construction is completed and the center marked by a suitable permanent mark.

3.4 PROTECTION

Provide protection around top of the excavation to prevent debris from being dislodged into the excavation and concrete.

-- End of Section --

SECTION 02620A

SUBDRAINAGE SYSTEM

09/01

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 27/A 27M	(1996) Steel Castings, Carbon, for General Application
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 48M	(1994ael) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C 139	(1999) Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 5034	(1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM F 758	(1995) Smooth-Wall Poly(Vinyl Chloride)

(PVC) Plastic Underdrain Systems for
Highway, Airport, and Similar Drainage

ASTM F 949

(2000) Poly(Vinyl Chloride) (PVC)
Corrugated Sewer Pipe With a Smooth
Interior and Fittings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Samples

Filter Fabric;
Pipe for Subdrains;

Samples of filter fabric, pipe, and pipe fittings, before
starting the work.

SD-07 Certificates

Filter Fabric;
Pipe for Subdrains;

Certifications from the manufacturers attesting that materials
meet specification requirements. Certificates are required for
drain pipe, drain tile, fittings, and filter fabric.

1.3 DELIVER, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with minimum handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. During shipment and storage, filter fabric shall be wrapped in burlap or similar heavy duty protective covering. The storage area shall protect the fabric from mud, soil, dust, and debris. Filter fabric materials that are not to be installed immediately shall not be stored in direct sunlight. Plastic pipe shall be installed within 6 months from the date of manufacture unless otherwise approved.

1.3.2 Handling

Materials shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried and not dragged to the trench.

PART 2 PRODUCTS

2.1 PIPE FOR SUBDRAINS

Pipe for subdrains shall be of the types and sizes indicated.

2.1.1 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

2.1.1.1 Polyvinyl Chloride (PVC) Pipe and Fittings

Polyvinyl chloride (PVC) pipe and fittings shall conform to ASTM F 758, Type PS 46.

2.1.1.2 Pipe Perforations

Water inlet area shall be a minimum of 1,058.4 mm squared per linear meter.

Manufacturer's standard perforated pipe which essentially meets these requirements may be substituted with prior approval of the Contracting Officer.

- a. Circular Perforations in Plastic Pipe: Circular holes shall be cleanly cut not more than 9.5 mm or less than 4.8 mm in diameter and arranged in rows parallel to the longitudinal axis of the pipe. Perforations shall be approximately 76.2 mm center-to-center along rows. The rows shall be approximately 38.1 mm apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows shall be spaced over not more than 155 degrees of circumference. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket, and perforations shall continue at uniform spacing over the entire length of the pipe.
- b. Slotted Perforations in Plastic Pipe: Circumferential slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length and circumference of the tubing. Width of slots shall not exceed 3.2 mm nor be less than 0.8 mm. The length of individual slots shall not exceed 31.75 mm on 80 mm diameter tubing, 10 percent of the tubing inside nominal circumference on 100 to 200 mm diameter tubing, and 63.5 mm on 250 mm diameter tubing. Rows of slots shall be symmetrically spaced so that they are fully contained in 2 quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe.

2.2 FILTER FABRIC

Filter fabric shall be a pervious sheet of polyester, nylon, or polypropylene filaments woven or otherwise formed into a uniform pattern with distinct and measurable openings. The filter fabric shall provide an equivalent opening size (AOS) no finer than the US Standard Sieve No. 120 and no coarser than the US Standard Sieve No. 70. AOS is defined as the number of the US Standard sieve having openings closest in size to the filter fabric openings. The filaments shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene, or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. The fabric shall have a minimum physical strength of 667.2 N per meter in any direction when tested in accordance with ASTM D 5034 using the grab test method with 645.2 square mm jaws and a constant rate of travel of 304.8 mm per minute. Elongation at failure shall be between 30 and 70 percent. The fabric shall be constructed so that the filaments will retain their relative position

with respect to each other. The edges of the fabric shall be selvaged or otherwise finished to prevent the outer material from pulling away from the fabric.

2.3 DRAINAGE STRUCTURES

2.3.1 Concrete

Except for precast concrete, reinforcement shall conform to the requirements for 21 MPa concrete in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixtures shall have air content, by volume of concrete, based on measurements made immediately after discharge from the mixer of 5 to 7 percent when coarse-aggregate maximum size is 38.1 mm or smaller. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall be not less than 25.4 mm thick for covers and not less than 38.1 mm thick for walls and flooring. Concrete covering deposited directly against the ground shall be at least 76.2 mm thick between the steel and the ground. Expansion-joint filler material shall conform to ASTM D 1751 or ASTM D 1752. Exposed concrete surfaces, such as drainage structures that form a continuation of concrete curbs and gutters, shall be given a protective coating of linseed oil as specified in Section 02770 CONCRETE SIDEWALKS AND CURBS AND GUTTERS.

2.3.2 Mortar

Mortar for pipe joints and connections to other drainage structures shall be composed of one part by volume of portland cement and two parts of sand. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of injurious acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes from the time the ingredients are mixed with water.

2.3.3 Manholes and Appurtenances

2.3.3.1 Precast Reinforced Concrete Manhole Risers and Tops

Precast reinforced concrete manhole risers and tops shall conform to ASTM C 478M .

2.3.3.2 Precast Concrete Segmental Blocks

Precast concrete segmental blocks shall conform to ASTM C 139 and shall be not more than 203.2 mm thick, not less than 203.2 mm long, and of such shape that the joints can be effectively sealed and bonded with cement mortar.

2.3.3.3 Precast Concrete Manhole Bases

If precast concrete manhole bases are used, the bases shall conform to ASTM C 478M and shall be of such a design as to effect suitable connection with influent and effluent lines and to provide a suitable base structure for riser sections.

2.3.3.4 Frames and Covers or Gratings

Frames and gratings, or frames and covers, except as otherwise permitted, shall be of either cast iron with tensile strength test not less than ASTM A 48M Class 25 or steel conforming to ASTM A 27/A 27M, Class 65-35. Weight, shape, and size shall be as indicated. Frames and covers not

subjected to vehicular traffic or storage may be of malleable iron where indicated. The malleable-iron frames and covers shall conform to ASTM A 47/A 47M and shall be of the weight, shape, and size indicated.

2.3.3.5 Steel Ladder

A steel ladder shall be provided where the depth of a manhole exceeds 3.66 m.

The ladder will be not less than 400 mm in width, with 19.1 mm diameter rungs spaced 304.8 mm apart. [AM#2} The ladder shall extend to within 304.8 mm from the top and bottom of the manhole. The two stringers shall be a minimum 9.5 mm thick and 50.8 mm wide. Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 1.83 m apart vertically, and shall be so installed as to provide at least 152.4 mm of space between the wall and the rungs. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M. The wall along the line of the ladder shall be vertical for its entire length.

2.4 SUBDRAIN FILTER AND BEDDING MATERIAL

Subdrain filter and bedding material shall be in accordance with Section 02714 DRAINAGE LAYER.

PART 3 EXECUTION

3.1 EXCAVATION AND BEDDING FOR SUBDRAIN SYSTEMS

Trenching and excavation, including the removal of rock and unstable material, shall be in accordance with Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Bedding material shall be placed in the trench as indicated or as required as replacement materials used in those areas where unstable materials were removed. Compaction of the bedding material shall be as specified for cohesionless material in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2 MANHOLES AND FLUSHING AND OBSERVATION RISERS

3.2.1 Manholes

Manholes shall be installed complete with frames and covers or gratings at the locations and within the limits and sizes indicated. Manholes shall be constructed of one of the materials specified for manholes in paragraph DRAINAGE STRUCTURES. Joints shall be completely filled and shall be smooth and free of surplus mortar or mastic on the inside of the structure. Brick manholes shall be plastered with 12.7 mm of mortar over the entire outside surface of the walls. Brick for square or rectangular structures shall be laid in stretcher courses with a header course every sixth course. Brick for round structures shall be laid radially with every sixth course laid as a stretcher course. Ladders shall be installed in manholes as indicated. Base for manholes shall be either precast or cast-in-place concrete.

3.2.2 Flushing and Observation Risers (Drainage Layer Cleanouts)

Flushing and observation riser pipes with frames and covers shall be installed at the locations indicated. Risers shall be constructed of precast concrete, vitrified clay, or galvanized corrugated metal pipe. Joining of riser pipes to the subdrain system shall be as indicated.

3.3 INSTALLATION OF FILTER FABRIC AND PIPE FOR SUBDRAINS

3.3.1 Installation of Filter Fabric

3.3.1.1 Trench Lining and Overlaps

Trenches to be lined with filter fabric shall be graded to obtain smooth side and bottom surfaces so that the fabric will not bridge cavities in the soil or be damaged by projecting rock. The fabric shall be laid flat but not stretched on the soil, and it shall be secured with anchor pins. Overlaps shall be at least 50 mm, and anchor pins shall be used along the overlaps.

3.3.2 Installation of Pipe for Subdrains

3.3.2.1 Pipelaying

Each pipe shall be carefully inspected before it is laid. Any defective or damaged pipe shall be rejected. No pipe shall be laid when the trench conditions or weather is unsuitable for such work. Water shall be removed from trenches by sump pumping or other approved methods. The pipe shall be laid to the grades and alignment as indicated. The pipe shall be bedded to the established gradeline. Perforations shall be centered on the bottom of the pipe. Pipes of either the bell-and-spigot type or the tongue-and-groove type shall be laid with the bell or groove ends upstream. All pipes in place shall be approved before backfilling.

3.3.2.2 Jointings

- a. Polyvinyl Chloride (PVC) Pipe: Joints shall be in accordance with the requirements of ASTM D 3034, ASTM D 3212, or ASTM F 949.

3.4 INSTALLATION OF AND BACKFILLING FOR BLIND OR FRENCH DRAINS

Filter material shall be placed as indicated and compacted as specified for cohesionless materials in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Filter material shall extend to a suitable outlet or to an outlet through a pipeline as indicated. Overlying backfill material shall be placed and compacted as specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.5 INSTALLATION OF FILTER MATERIAL AND BACKFILLING FOR SUBDRAINS

After pipe for subdrains has been laid, inspected, and approved, filter material shall be placed around and over the pipe to the depth indicated. The filter material shall be placed in layers not to exceed 200 mm thick, and each layer shall be thoroughly compacted by mechanical tampers or rammers to obtain the required density. Compaction of filter material and the placement and compaction of overlying backfill material shall be in accordance with the applicable provisions specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.6 TESTS

3.6.1 Pipe Test

Strength tests of pipe shall conform to field service test requirements of the Federal Specification, ASTM specification, or AASHTO specification covering the product (paragraph PIPE FOR SUBDRAINS).

3.6.2 JP-4 Fuel Resistance Test

Five unaged fabric samples, 97 to 107 mm by 147 to 157 mm shall be immersed in JP-4 fuel at room temperature for a period of 7 days. Each sample then shall be tested for tensile strength and elongation in accordance with ASTM D 5034. The strength of the fabric in any direction shall be no less than 85 percent of the strength specified in paragraph FILTER FABRIC.

-- End of Section --

SECTION 02630A

STORM-DRAINAGE SYSTEM

03/00

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 190 (1995) Bituminous Coated Corrugated Metal
Culvert Pipe and Pipe Arches

AASHTO M 243 (1996) Field Applied Coating of Corrugated
Metal Structural Plate for Pipe,
Pipe-Arches, and Arches

AMERICAN RAILWAY ENGINEERING & MAINTENANCE-OF-WAY ASSOCIATION
(AREMA)

AREMA Manual (1999) Manual for Railway Engineering (4
Vol.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48M (1994 el) Gray Iron Castings (Metric)

ASTM A 536 (1999el) Ductile Iron Castings

ASTM A 742/A 742M (1998) Steel Sheet, Metallic Coated and
Polymer Precoated for Corrugated Steel Pipe

ASTM A 760/A 760M (1997) Corrugated Steel Pipe,
Metallic-Coated for Sewers and Drains

ASTM A 762/A 762M (1998) Corrugated Steel Pipe, Polymer
Precoated for Sewers and Drains

ASTM A 798/A 798M (1997a) Installing Factory-Made Corrugated
Steel Pipe for Sewers and Other
Applications

ASTM A 807 (1997) Installing Corrugated Steel
Structural Plate Pipe for Sewers and Other
Applications

ASTM A 849 (1997) Post-Applied Coatings, Pavings, and
Linings for Corrugated Steel Sewer and
Drainage Pipe

ASTM A 929/A 929M	(1997) Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM B 26/B 26M	(1998) Aluminum-Alloy Sand Castings
ASTM C 76M	(1999a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 139	(1999) Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1997) Mortar for Unit Masonry
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 655	(1995a) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C 789	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
ASTM C 850	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Ft. of Cover Subjected to Highway Loadings
ASTM C 877M	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other

Gravity-Flow Applications

ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM F 679	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 949	(1999) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Placing Pipe;

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-04 Samples

Pipe for Culverts and Storm Drains;

SD-07 Certificates

Resin Certification;
Pipeline Testing;
Hydrostatic Test on Watertight Joints;
Determination of Density;
Frame and Cover for Gratings;

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C 76M , Class III , or ASTM C 655, 3000 D-Load.

2.1.2 Fully Bituminous Coated, Fully Paved

AASHTO M 190 Type D and ASTM A 760/A 760M zinc or aluminum (Type 2) coated Type I pipe with helical 68 by 13 mm corrugations.

2.1.2.1 Concrete-Lined

ASTM A 760/A 760M zinc coated Type I corrugated steel pipe with helical 68 by 13 mm corrugations and a concrete lining in accordance with ASTM A 849.

2.1.2.2 Polymer Precoated, Fully Paved

ASTM A 762/A 762M Type I corrugated steel pipe and AASHTO M 190 Type D (modified), fully paved only, fabricated from ASTM A 742/A 742M Grade 250/250 polymer precoated sheet with helical 68 by 13 mm corrugations.

2.1.3 PVC Pipe

The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, shall be submitted prior to installation of the pipe.

2.1.3.1 Profile PVC Pipe

ASTM F 794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.2 Smooth Wall PVC Pipe

ASTM F 679 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.3 Corrugated PVC Pipe

ASTM F 949 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A 929/A 929M.

2.2.2 Precast Reinforced Concrete Box

For highway loadings with 600 mm of cover or more or subjected to dead load only, ASTM C 789; for less than 600 mm of cover subjected to highway loading, ASTM C 850.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 21 MPa concrete under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 37.5 mm. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 25 mm thick for covers and not less than 40 mm thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 75 mm between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalies, and organic impurities.

The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.3.3 Precast Concrete Segmental Blocks

Precast concrete segmental block shall conform to ASTM C 139, not more than 200 mm thick, not less than 200 mm long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

2.3.4 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478M . Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure .

2.3.5 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48M , Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26/B 26M, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3.6 Joints

2.3.6.1 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877M .

2.3.6.2 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 02316 "Excavation, Trenching, and Backfilling for Utilities Systems" and Section 02300 "Earthwork" and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not [AM#2] less than the outside diameter of the pipe plus 300 mm to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary.

Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 200 mm or 13 mm for each meter of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 02316 "Excavation, Trenching, and Backfilling for Utilities Systems".

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. Bedding and initial fill, initial fill shall be free from stones larger than 25 mm and will be used to a point 300 mm above the pipe.

3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.2.2 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A 798/A 798M. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, the Contractor shall either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Bedding for corrugated structural plate pipe shall meet requirements of ASTM A 807.

3.2.3 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel and Aluminum Alloy	5
Concrete-Lined Corrugated Steel	3
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Government may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.3.1 Concrete, and PVC Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Corrugated Metal Pipe

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Part paved pipe shall be installed so that the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Fully paved steel pipe or pipe arch shall have a painted or otherwise applied label inside the pipe or pipe arch indicating sheet thickness of pipe or pipe arch. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling bands shall be handled with care to preclude damage to the coating, paving or lining. Damaged coatings, pavings and linings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating, paving or lining has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.

3.3.3 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 1 meter apart, whichever is less.

3.3.4 Jacking Pipe Through Fills

Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Volume 1, Chapter 1, Part 4 of AREMA

Manual.

3.4 JOINTING

3.4.1 Concrete

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be thoroughly cleaned with a wet brush and the lower portion of the bell filled with mortar as required to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.

- a. Diaper Bands: Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in lengths that extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 200 mm apart. Wires shall be cut into lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.

- b. Grout: Grout shall be poured between band and pipe from the high side of band only, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be forced out by pouring, and removed.
- c. Remainder of Joint: The remaining unfilled upper portion of the joint shall be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.

3.4.1.4 Cement-Mortar Tongue-and-Groove Joint

The first pipe shall be bedded carefully to the established gradeline with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the pipe. The grooved end of the first pipe shall be thoroughly cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned with a wet brush; while in horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe shall be inserted in the grooved end of the first pipe until mortar is squeezed out on interior and exterior surfaces. Sufficient mortar shall be used to fill the joint completely and to form a bead on the outside.

3.4.1.5 Cement-Mortar Diaper Joint for Tongue-and-Groove Pipe

The joint shall be of the type described for cement-mortar tongue-and-groove joint in this paragraph, except that the shallow excavation directly beneath the joint shall not be filled with mortar until after a gauze or cheesecloth band dipped in cement mortar has been wrapped around the outside of the joint. The cement-mortar bead at the joint shall be at least 15 mm, thick and the width of the diaper band shall be at least 200 mm. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind the actual laying of the pipe. Backfilling around the joints shall not be done until the joints have been fully inspected and approved.

3.4.1.6 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe

Sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than 3 hours prior to installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe, and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions shall be cut

off flush with the inner surface of the pipe. If nonmastic-type sealant material is used, the "Squeeze-Out" requirement above will be waived.

3.4.2 Corrugated Metal Pipe

3.4.2.1 Field Joints

Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798/A 798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 750 mm or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal; complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated.

3.5.2 Walls and Headwalls

Construction shall be as indicated.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 150 mm in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 300 mm above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 150 millimeters. Tests for density shall be made as necessary to ensure conformance to the compaction

requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 150 mm in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 300 mm above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 4 m, whichever is less. After the backfill has reached at least 300 mm above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 150 mm.

3.6.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.4 Compaction

3.6.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

- a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
- b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
- c. Under nontraffic areas, density shall be not less than that of the

surrounding material.

3.6.5 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.6.5.1 Frequency of Testing

a) Compaction test (optimum moisture curve) and gradation and Atterberg limits for soil classification. (Tests required: One each, for each type of soil or combination of materials.)

b) In-Place Moisture Density Tests

1. Under paved areas. (Tests required: One per 30 linear meters of trench each 150 mm lift of compacted material or fraction thereof.)

2. Under grassed or non-traffic areas. (Tests required: One per 90 linear meters of trench each 305 mm lift of compacted material or fraction thereof.)

-- End of Section --

SECTION 02712A

[AM#2] DELETED

SECTION 02714A

DRAINAGE LAYER

07/01

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO MP 1	(1998) Provisional Specification for Performance Graded Asphalt Binder
AASHTO T 102	(1983; R 1996) Spot Test of Asphaltic Materials

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 150	(1999a) Portland Cement
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 1250	(1980; R 1997el) Petroleum Measurement Tables
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock In Place by Nuclear Methods (Shallow Depth)
ASTM D 3381	(1982; R 1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM E 548	(1994el) General Criteria Used for Evaluating Laboratory Competence

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Sampling and Testing; G

Copies of field test results within 24 hours of completion of tests.

Approval of Materials; G

Material sources and material test results prior to field use.

Evaluation; G

Test section construction report.

1.3 Bituminous or Cement Stabilized Drainage Layer

The quantity of bituminous or cement stabilized drainage layer material completed and accepted shall be measured in metric tons , excluding the weight of the asphalt or portland cement used in the mix.

1.3.1 Bituminous Material

The quantity of asphalt cement used in the bituminous stabilized mix shall be measured by the number of liters of material used in the accepted work corrected to liters at 16 degrees C in accordance with ASTM D 1250.

1.4 SYSTEM DESCRIPTION

The Contractor shall build a drainage layer under the pavements as indicated on drawings and the drainage layer shall consist of [AM#2]Rapid Draining Material (RDM).[AM#2]

1.5 FIELD COMPACTION

Field compaction requirements shall be based on the results of a test section constructed by the Contractor, using the materials, methods, and equipment proposed for use in the work. The test section shall meet the requirements of paragraph TEST SECTION.

1.6 EQUIPMENT

1.6.1 General Requirements

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times.

1.6.2 Placement Equipment

An asphalt paving machine shall be used to place drainage layer material.

1.6.3 Compaction Equipment

A dual or single smooth 10 ton (min.) vibratory drum roller which provides a maximum compactive effort without crushing the drainage layer aggregate shall be used to compact drainage layer material.

1.7 WEATHER LIMITATION

Drainage layer material shall be placed when the atmospheric temperature is above 2 degrees C . Areas of completed drainage layer or underlying courses that are damaged by freezing, rainfall, or other weather conditions or by contamination from sediments, dust, dirt, or foreign material shall be corrected by the Contractor to meet specified requirements.

1.8 SAMPLING AND TESTING

1.8.1 General Requirements

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval. If the Contractor elects to establish testing facilities of his own, approval of such facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections required because of failure of the first inspection shall be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. Drainage layer materials shall be tested to establish compliance with the specified requirements.

1.8.2 Sampling

Aggregate samples shall be taken in accordance with ASTM D 75.

1.8.3 Test Methods

1.8.3.1 Sieve Analyses

Sieve analyses shall be made in accordance with ASTM C 117 and ASTM C 136.

1.8.3.2 Density Tests

Field density tests for drainage layers shall be made in accordance with ASTM D 2922 by Direct Transmission Method for the full depth of the lift. When using this method, ASTM D 3017 shall be used to determine the moisture content of the aggregate drainage layer material. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph "Calibration" of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed by the Contracting Officer.

1.8.3.3 Soundness Test

Soundness tests shall be made in accordance with ASTM C 88.

1.8.3.4 Los Angeles Abrasion Test

Los Angeles abrasion tests shall be made in accordance with ASTM C 131.

1.8.3.5 Flat or Elongated Particles Tests

Flat and/or elongated particles tests shall be made in accordance with ASTM D 4791.

1.8.3.6 Fractured Faces Tests

When aggregates are supplied from crushed gravel, approved test methods shall be used to assure the aggregate meets the requirements for fractured faces in paragraph AGGREGATES.

1.8.4 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis including 0.02 mm size material.
- b. Flat and/or elongated particles
- c. Fractured Faces
- d. Los Angeles abrasion.
- e. Soundness.

1.8.5 Testing Frequency

1.8.5.1 Aggregate Layer

Field density and moisture content tests shall be performed at a rate of at least one test for every 1000 square meters of completed area and not less than one test for each day's production. Sieve analyses shall be performed at a rate of at least one test for every 3000 square meters of completed area. Soundness tests, Los Angeles abrasion tests, fractured faces tests and flat and/or elongated particles tests shall be performed at

the rate of one test for every 12,000 square meters of production.

1.8.6 Approval of Materials

1.8.6.1 Aggregate

The aggregate source shall be selected at least 45 days prior to field use in the test section. Tentative approval of the source will be based on certified test results to verify that materials proposed for use meet the contract requirements. Final approval of both the source and the material will be based on test section performance and tests for gradation, soundness, Los Angeles abrasion, flat and/or elongated particles tests and fractured faces tests. For aggregate drainage layer materials, these tests shall be performed on samples taken from the completed and compacted drainage layer course within the test section. For bituminous or cement stabilized drainage layer material, these tests shall be performed on aggregate samples taken prior to addition of bituminous or cementitious material and subsequent placement in the test section.

1.8.6.2 [AM#2]1.8.6.2 Bituminous or Cementitious Materials

Bituminous or cementitious sources and certified material test results shall be submitted for approval not less than 60 days prior to field use in the test section.

PART 2 PRODUCTS

2.1 [AM#2]2.1 GOVERNMENT APPROVAL

Asphalt or cement stabilized material will require Government notification and delivery of approved materials in accordance with paragraph BITUMINOUS OR CEMENT STABILIZED JOB-MIX FORMULA.

2.2 AGGREGATES

Aggregates shall consist of clean, sound, hard, durable, angular particles of crushed stone, crushed slag, or crushed gravel which meet the specification requirements. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 1040 kg per cubic meter determined by ASTM C 29/C 29M. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings.

2.2.1 Aggregate Quality

The aggregate shall have a soundness loss not greater than 18 percent weighted averaged at 5 cycles when tested in magnesium sulfate in accordance with ASTM C 88. The aggregate shall have a percentage of loss on abrasion not to exceed 40 after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall be determined by ASTM D 4791 with the following modifications. The aggregates shall be separated into 2 size fractions. Particles greater than 12.5 mm sieve and particles passing the 12.5 mm sieve and retained on the 4.75 mm sieve. The percentage of flat and/or elongated particles in either fraction shall not exceed 20. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements. When the aggregate is supplied from crushed gravel it shall be manufactured

from gravel particles, 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE I. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the face. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as 2 fractured faces.

2.2.2 Gradation Requirements

Drainage layer aggregates shall be well graded within the limits specified in TABLE I.

TABLE I. GRADATION OF DRAINAGE LAYER MATERIAL

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	[AM#2]Rapid draining Material (RDM)	[AM#2]___	[AM#2]___	[AM#2]___
37.50 mm	100			
25.00 mm	70-100			
19.00 mm	55-100			
12.50 mm	40-80			
9.50 mm	30-65			
4.75 mm	10-50			
2.36 mm	0-25			
1.18 mm	0-5			

NOTE 1: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

[AM#2] DELETED

[AM#2]NOTE 2: For RDM, the coefficient of uniformity (CU) shall be greater than 3.5. (CU = D60/D10). The contractor is responsible for adjusting the RDM gradation within the ranges listed in Table I to provide a stable construction surface for the proposed equipment and method of transporting materials or the drainage layer can be stabilize with portland cement or asphalt at no additional cost to the government, if approved during the test section.

2.3 [AM#2]2.3 BITUMINOUS MATERIALS

Asphalt cement to be mixed with aggregates shall conform to ASTM D 3381 viscosity Grade AASHTO MP 1PG. In addition, the asphalt cement shall show a negative spot when subjected to the spot test in accordance with AASHTO T 102, using the standard naphtha specified.

2.4 [AM#2]2.4 CEMENTITIOUS MATERIALS

Portland cement to be mixed with aggregates shall conform to ASTM C 150, Type I, or II.

2.5 [AM#2]2.5 BITUMINOUS OR CEMENT STABILIZED JOB-MIX FORMULA

The bituminous stabilized mix shall consist of a mixture of RDM and a minimum of 2 percent asphalt cement by weight. Tolerances for bituminous stabilized material shall be maintained for field production at plus or minus 0.25 percent for asphalt cement and plus or minus 14 degrees C for mixing temperatures. The cement stabilized mix shall consist of RDM and a minimum of 90 kg of portland cement per cubic meter with a water/cement ratio of 0.37. Based on the test section performance, the Contractor shall be responsible for adjustments (increases) in asphalt cement or portland cement quantities to ensure the stabilized drainage layer will not rut or be disturbed by the Contractor's proposed paving method. The Contractor shall submit a job-mix formula (JMF) with the test section report for Contracting Officer approval.

PART 3 EXECUTION

3.1 STOCKPILING AGGREGATES

Aggregates shall be stockpiled at locations designated by the Contracting Officer. Stockpile areas shall be cleared and leveled prior to stockpiling aggregates. Aggregates shall be stockpiled to prevent segregation and contamination. Aggregates obtained from different sources shall be stockpiled separately.

3.2 TEST SECTION

3.2.1 Data

A test section shall be constructed to evaluate the ability to carry traffic, including placement of overlaying material and the constructability of the drainage layer including required mixing, placement, and compaction procedures. Test section data will be used by the Contracting Officer to validate the required number of compaction passes given in paragraph Compaction Requirements and the field dry density requirements for full scale production.

3.2.2 Scheduling

The test section shall be constructed a minimum of 14 days prior to the start of full scale production to provide sufficient time for an evaluation of the proposed materials, equipment and procedures including Government QA testing.

3.2.3 Location and Size

The test section shall be placed inside the production paving limits. The underlying courses and subgrade preparation, required for the pavement section, shall be completed, inspected and approved in the test section prior to constructing the drainage layer. The test section shall be a minimum of 45.7 m long and two full paving lanes wide side by side.

3.2.4 Initial Testing

Certified test results, to verify that the materials proposed for use in the test section meet the contract requirements, shall be provided by the Contractor and approved by the Contracting Officer prior to the start of the test section.

3.2.5 Mixing, Placement, and Compaction

Mixing, placement, and compaction shall be accomplished using equipment meeting the requirements of paragraph EQUIPMENT. Compaction equipment speed shall be no greater than 2.4 km/hour. Compaction shall start from the outside edges of the paving lane and proceed to the centerline of the lift being placed. The roller shall stay a minimum of one half the roller width from the outside edge of the drainage layer being placed until the desired density is obtained. The outside edge shall then be rolled.

3.2.6 Procedure

3.2.6.1 [AM#2]3.2.6.1 RDM Aggregate Drainage Layer Tests

The test section shall be constructed with aggregate in a wet state so as to establish a correlation between number of roller passes and dry density achievable during field production. Three separate areas within the test section shall be designated, each area shall be tested for density, moisture, and gradation. All testing shall be completed in the middle third of the test section being placed. Density and moisture content tests shall be conducted in accordance with ASTM D 2922 and ASTM D 3017. Sieve analysis tests shall be conducted on samples, taken adjacent to the density test locations. One set of tests (i.e. density, moisture, and sieve analysis) shall be taken before the third compaction pass and after each subsequent compaction pass at three separate locations as directed by the Contracting Officer. A pass shall be considered the movement of a roller over the drainage layer area for one direction only. Compaction for the RDM shall consist of a maximum of 5 passes in the vibrating state and one final pass in the static state. Compaction passes and density readings shall continue until the difference between the average dry densities of any two consecutive passes is less than or equal to 16 kg per cubic meter.

3.2.6.2 Bituminous/Cement Stabilized Drainage Layer

The test section shall be constructed with the same equipment used for production. Three separate areas within the test section shall be designated for sampling. All testing shall be completed in the middle third of the test section being placed. Visual examination of each sample shall be made by the contracting officer to determine if and when crushing of aggregate occurs. One sample shall be taken by the contractor before compaction and after each subsequent compaction pass at three separate locations as directed by the Contracting Officer. Compaction shall continue for a maximum of 6 passes. A pass shall be considered the movement of a roller over the drainage layer area for one direction only. Placement procedures and equipment shall be as described herein. The contracting officer shall determine the number of passes required for compaction from the test section.

3.2.6.3 [AM#2]3.2.6.3 DELETED

3.2.7 Evaluation

Within 10 days of completion of the test section, the Contractor shall submit to the Contracting Officer a Test Section Construction Report complete with all required test data and correlations. The Contracting Officer will evaluate the data and validate the required number of passes of the roller, the need for a final static pass of the roller, and provide the dry density for field density control during construction.

3.3 PREPARATION OF UNDERLYING COURSE

Prior to constructing the drainage layer, the underlying course shall be cleaned of all foreign materials. During construction, the underlying course shall contain no frozen material. The underlying course shall conform to Section 02721 SUBBASE COURSES. Ruts or soft yielding spots in the underlying courses having inadequate compaction and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line, and grade, and recompacting to specified density. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the drainage layer is placed.

3.4 TRANSPORTING MATERIAL

3.4.1 Aggregate Drainage Layer Material

Aggregate drainage layer material shall be transported to the site in a manner which prevents segregation and contamination of materials.

3.5 PLACING

3.5.1 General Requisites

Drainage layer material shall be placed on the underlying course in lifts of uniform thickness using equipment meeting the requirements of paragraph EQUIPMENT. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single lift. When a compacted layer in excess of 150 mm is required, the material shall be placed in lifts of equal thickness. No lift shall exceed 150 mm or be less than 75 mm when compacted. The lifts when compacted after placement shall be true to the grades or levels required with the least possible surface disturbance. Where the drainage layer is placed in more than one lift, the previously constructed lift shall be cleaned of loose and foreign material.

Such adjustments in placing procedures or equipment shall be made to obtain true grades and minimize segregation and degradation of the drainage layer material. [AM#2] _____

3.5.2 [AM#2]3.5.2 Placement of Stabilized Material

Bituminous stabilized material having temperatures less than 80 degrees C when dumped into the asphalt paving machine will be rejected. The paving machine shall be adjusted so that the surface of the lift being laid will be smooth and continuous without tears and pulls. Irregularities in alignment of the lift left by the paving machine shall be corrected by trimming directly behind the machine. Immediately after trimming, the edges of the lift shall be thoroughly compacted by a method approved by the Contracting Officer. Distortion of the lift during tamping will not be permitted. If more than one lift is required, the longitudinal joint in one lift shall offset that in the lift immediately below by at least 300 mm; however, the joint in the top layer shall be at the centerline of the pavement. Transverse joints in one layer shall be offset by at least 600 mm from transverse joints in the previous layer. Transverse joints in adjacent strips shall be offset a minimum of 3 meters. At the end of each day's construction, a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face free of loose or shattered material. Material along construction joints not properly compacted shall be removed.

3.5.3 [AM#]3.5.3 Placing Adjacent Stabilized Strips

The stabilized material shall be placed in consecutive adjacent strips having a minimum width of 3 meters, except where edge lanes require strips less than 3 meters to complete the area. In placing adjacent strips, the screed of the paving machine shall overlap the previously placed strip 75 to 100 mm and shall be sufficiently high so that compaction will produce a smooth, dense joint. The stabilized material placed on the edge of the previously placed strip by the paver shall be pushed back to the edge of the strip being placed. Excess stabilized material shall be removed and wasted.

3.5.4 Hand Spreading

In areas where machine spreading is impractical, drainage layer material shall be spread by hand. The material shall be spread uniformly in a loose layer to prevent segregation. The material shall conform to the required grade and thickness after compaction.

3.6 COMPACTION REQUIREMENTS

Compaction shall be accomplished using rollers meeting the requirements of paragraph EQUIPMENT and operating at a rolling speed of no greater than 2.4 km per hour. Each lift of drainage material, including shoulders when specified under the shoulders, shall be compacted with the number of passes of the roller as follows: [AM#2]RDM material shall use 4 passes in the vibratory state and one in the static. [AM#2]_____The Contracting Officer will validate the number of roller passes after the test section is evaluated and before production starts. In addition, a minimum field dry density, as specified by the Contracting Officer, shall be maintained. If the required field dry density is not obtained, the number of roller passes shall be adjusted in accordance with paragraph DEFICIENCIES. Aggregate shall be compacted in a moisture state as determined in the test section. Excessive rolling resulting in crushing of aggregate particles shall be avoided. [AM#2]_____In all places not accessible to the rollers, the drainage layer material shall be compacted with mechanical hand operated tampers.

3.7 FINISHING

The top surface of the drainage layer shall be finished after final compaction as determined from the test section. Adjustments in rolling and finishing procedures shall be made to obtain grades and minimize segregation and degradation of the drainage layer material.

3.8 EDGES OF DRAINAGE LAYER

Shoulder material shall be placed along the edges of the drainage layer course in a quantity that will compact to the thickness of the layer being constructed. At least 1 m width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each lift of the drainage layer.

3.9 SMOOTHNESS TEST

The surface of the top lift shall not deviate more than 10 mm when tested with either a 3.05 m or 3.66 m straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 10 mm shall be corrected in accordance with paragraph

DEFICIENCIES.

3.10 THICKNESS CONTROL

The completed thickness of the drainage layer shall be within 13 mm of the thickness indicated. Thickness shall be measured at intervals providing at least one measurement for each 500 square meters of drainage layer. Measurements shall be made in test holes at least 75 mm in diameter unless the contractor can demonstrate, for COR approval, that a steel rod pushed through the drainage layer clearly stops at the material interface. Where the measured thickness is more than 13 mm deficient, such areas shall be corrected in accordance with paragraph DEFICIENCIES. Where the measured thickness is 13 mm more than indicated, it will be considered as conforming to the requirements plus 13 mm, provided the surface of the drainage layer is within 13 mm of established grade. The average job thickness shall be the average of all job measurements as specified above but within 8 mm of the thickness shown on the drawings.

3.11 DEFICIENCIES

3.11.1 Grade and Thickness

Deficiencies in grade and thickness shall be corrected so that both grade and thickness tolerances are met. Thin layers of material shall not be added to the top surface of the drainage layer to meet grade or increase thickness. If the elevation of the top of the drainage layer is more than 13 mm above the plan grade it shall be trimmed to grade and finished in accordance with paragraph FINISHING. If the elevation of the top surface of the drainage layer is 13 mm or more below the required grade, the surface of the drainage layer shall be scarified to a depth of at least 75 mm, new material shall be added, and the layer shall be blended and recompacted to bring it to grade. Where the measured thickness of the drainage layer is more than 13 mm deficient, such areas shall be corrected by excavating to the required depth and replaced with new material to obtain a compacted lift thickness of at least 75 mm. The depth of required excavation shall be controlled to keep the final surface elevation within grade requirements and to preserve layer thicknesses of materials below the drainage layer.

3.11.2 Density

Density shall be considered deficient if the field dry density test results are below the dry density specified by the Contracting Officer. If the densities are deficient, the layer shall be rolled with 2 additional passes of the specified roller. If the dry density is still deficient, work will be stopped until the cause of the low dry densities can be determined and reported to the Contracting Officer.

3.11.3 Smoothness

Deficiencies in smoothness shall be corrected as if they are deficiencies in grade or thickness. All tolerances for grade and thickness shall be maintained while correcting smoothness deficiencies.

-- End of Section --

SECTION 02721A

SUBBASE COURSES

03/97

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregates
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 1556	(1990; R 1996el) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment;

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-06 Test Reports

Sampling and Testing; G

Copies of initial and in-place test results.

1.3 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 Method C. In this specification, degree of compaction shall be a percentage of laboratory maximum density.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

A minimum of one analysis shall be performed for each Day's Delivery, of material placed.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

One test each for liquid limit and plasticity index shall be performed for each sieve analysis.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture shall be determined in accordance with ASTM D 1557 .

1.4.2.4 Density Tests

Density shall be field measured in accordance with ASTM D 1556. The base plate, as shown in the drawing shall be used. ASTM D 2922. The calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication.

Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed.

At least one field density test shall be performed for each 2400 square meters of each 150 mm thick layer of compacted material or fraction thereof.

1.4.2.5 Wear Test

Wear tests shall be made on subbase course material in conformance with ASTM C 131.

One test shall be run for each 2500 square meters of completed subbase course, or fraction thereof.

1.4.2.6 Weight of Slag

Weight per cubic meter of slag shall be determined in accordance with ASTM C 29/C 29M on the subbase course material.

1.4.2.7 Laboratory Maximum Density

At least one test for moisture density relationship shall be run for each type of material or combination of material.

1.4.2.8 Thickness

At least one measurement for each 400 square meters of subbase course.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation.

- a. Sieve Analysis
- b. Liquid limit and plasticity index moisture-density relationship
- c. Wear

- d. Weight per cubic meter of Slag

1.4.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted subbase course. Samples shall be taken for each 850 square meters of each layer of material placed in each area.

- a. Sieve Analysis
- b. Moisture liquid limit and plasticity index

1.4.4 Approval of Material

The source of the material shall be selected 45 days prior to the time the material will be required in the work. Approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 EQUIPMENT

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Subbase Course

Aggregates shall consist of crushed stone or slag, gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the 4.75 mm sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM C 131. Aggregate shall be reasonably uniform in density and quality. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 1050 kg/cubic meter. Aggregates shall have a maximum size of 50 mm and shall be within the limits specified as follows or Contractor can opt to use THD Item 247A, Grade I or II aggregate:

Maximum Allowable Percentage by Weight
Passing Square-Mesh Sieve

Sieve Designation	No. 1
-------------------	-------

2 mm	50
0.075 mm	15

The portion of any blended component and of the completed course passing the 0.425 mm shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 OPERATION OF AGGREGATE SOURCES

All clearing, stripping and excavating work involved in the opening or operation of aggregate sources shall be performed by the Contractor. Aggregate sources shall be opened to working depth in a manner that produces excavation faces that are as nearly vertical as practicable for the materials being excavated. Materials excavated from aggregate sources shall be obtained in successive cuts extending through all exposed strata. All pockets or strata of unsuitable materials overlying or occurring in the deposit shall be wasted as directed. The methods of operating aggregate sources and the processing and blending of the material may be changed or modified by the Contracting Officer, when necessary, in order to obtain material conforming to specified requirements. Upon completion of work, aggregate sources on Government reservations shall be conditioned to drain readily, and shall be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the subbase or select-material subbase course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the subbase course is placed.

3.4 GRADE CONTROL

The finished and completed subbase course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the work site.

3.5 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the subbase material at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

3.6 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 150 mm is specified, the material may be placed in a single layer; when a compacted thickness of more than 150 mm is required, no layer shall exceed 150 mm nor be less than 75 mm when compacted.

3.7 COMPACTION

Each layer of the subbase course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2.0 percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. [AM#2] Under Portland Cement concrete and 100% under asphalt pavement. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.8 EDGES

Approved material shall be placed along the edges of the subbase course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 300 mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the subbase course, as directed.

3.9 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 10 mm when tested with a 3.6 m straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.10 THICKNESS CONTROL

The completed thickness of the subbase course shall be in accordance with the thickness and grade indicated on the drawings. The thickness of each course shall be measured at intervals providing at least one measurement for each 400 square meters or part thereof of subbase course. The thickness measurement shall be made by test holes, at least 75 mm in diameter through the course. The completed subbase course shall not be more than 13 mm deficient in thickness nor more than 13 mm above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 13 mm or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 13 mm. The average job thickness shall be the average of the job measurements as specified above but within 6 mm of the thickness shown.

3.11 MAINTENANCE

The subbase course shall be maintained in a satisfactory condition until accepted.

-- End of Section --

SECTION 02749

HOT-MIX ASPHALT (HMA) FOR AIRFIELDS

03/02

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

- | | |
|-------------|------------------------------------------------------------------------------------|
| AASHTO MP 1 | (1998) Provisional Specification for
Performance Graded Asphalt Binder |
| AASHTO TP53 | (2000) Determining Asphalt Content of Hot
Mix Asphalt by the Ignition Method ** |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-----------------|-------------------------------------------------------------------------------------------------------------------------|
| ASTM C 117 | (1995) Materials Finer Than 75 micrometer
(No. 200) Sieve in Mineral Aggregates by
Washing |
| ASTM C 1252 | (1998) Uncompacted Void Content of Fine
Aggregate (as Influenced by Particle
Shape, Surface Texture, and Grading) |
| ASTM C 131 | (1996) Resistance to Degradation of
Small-Size Coarse Aggregate by Abrasion
and Impact in the Los Angeles Machine |
| ASTM C 136 | (1996a) Sieve Analysis of Fine and Coarse
Aggregates |
| ASTM C 29/C 29M | (1997) Bulk Density ("Unit Weight") and
Voids in Aggregates |
| ASTM C 566 | (1997) Total Evaporable Moisture Content
of Aggregate by Drying |
| ASTM C 88 | (1999a) Soundness of Aggregates by Use of
Sodium Sulfate or Magnesium Sulfate |
| ASTM D 140 | (2000) Sampling Bituminous Materials |
| ASTM D 1461 | (1985; R 1994) Moisture or Volatile
Distillates in Bituminous Paving Mixtures |
| ASTM D 1559 | (1989) Resistance to Plastic Flow of
Bituminous Mixtures Using Marshall
Apparatus \N(Deleted; continued use |

without replacement.)

ASTM D 2041	(1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2419	(1995) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 242	(1995) Mineral Filler for Bituminous Paving Mixtures
ASTM D 2489	(2000) Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D 2726	(2000) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture
ASTM D 2950	(1997) Density of Bituminous Concrete in Place by Nuclear Method
ASTM D 3203	(1994; R 2000) Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
ASTM D 3381	(1992; R 1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3665	(1999) Random Sampling of Construction Materials
ASTM D 3666	(2000) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 4125	(1994e1) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4867/D 4867M	(1996) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate
ASTM D 6307	(1998) Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D 946	(1982; R 1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 995	(1995b) Mixing Plants for Hot-Mixed,

Hot-Laid Bituminous Paving Mixtures

ASPHALT INSTITUTE (AI)

AI MS-2 (1997) Mix Design Methods for Asphalt
Concrete and Other Hot-Mix Types

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

CDT Test 526 (1978) Operation of California
Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 171 (1995) Test Method for Determining
Percentage of Crushed Particles in
Aggregate

1.2 DESCRIPTION OF WORK

The work shall consist of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design; G

Proposed JMF.

Contractor Quality Control; G

Quality control plan.

SD-04 Samples

Asphalt Cement Binder;

5 gallon sample for mix design verification.

Aggregates;

Sufficient materials to produce 200 lb of blended mixture for
mix design verification.

SD-06 Test Reports

Aggregates; G,
QC Monitoring;

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder; G

Copies of certified test data.

Testing Laboratory; G

Certification of compliance.

1.4 METHOD OF MEASUREMENT (Am#2)

The amount paid for will be the number of metric tons of hot-mix asphalt mixture used in the accepted work. Hot-mix asphalt mixture shall be weighed after mixing, and no separate payment will be made for weight of asphalt cement material incorporated herein.

1.5 BASIS OF PAYMENT (Am#2)

Quantities of wearing-course mixture, determined as specified above, will be paid for at respective contract unit prices or at reduced prices adjusted in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT. Payment shall constitute full compensation for furnishing all materials, equipment, plant, and tools; and for all labor and other incidentals necessary to complete work required by this section of the specification.

1.6 ASPHALT MIXING PLANT

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of ASTM D 995 with the following changes:

a. Truck Scales. The asphalt mixture shall be weighed on approved scales furnished by the Contractor, or on certified public scales at the Contractor's expense. Scales shall be inspected and sealed at least annually by an approved calibration laboratory.

b. Testing Facilities. The Contractor shall provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

c. Inspection of Plant. The Contracting Officer shall have access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. The Contractor shall provide assistance as requested, for the Government to procure any desired samples.

d. Storage Bins. The asphalt mixture may be stored in non-insulated storage bins for a period of time not exceeding 3 hours. The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 8 hours. The mix drawn from bins shall meet the same

requirements as mix loaded directly into trucks.

1.7 HAULING EQUIPMENT

Trucks used for hauling hot-mix asphalt shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

1.8 ASPHALT PAVERS

Asphalt pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1.8.1 Receiving Hopper

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

1.8.2 Automatic Grade Controls

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A transverse slope controller shall not be used to control grade. The controls shall be capable of working in conjunction with any of the following attachments:

- a. Ski-type device of not less than 30 feet in length.
- b. Taut stringline set to grade.
- c. Short ski or shoe for joint matching.
- d. Laser control.

1.9 ROLLERS

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Equipment which causes

excessive crushing of the aggregate shall not be used.

1.10 WEATHER LIMITATIONS

The hot-mix asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 1. Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
3 or greater	40
Less than 3	45

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The portion of material retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. All aggregate test results and samples shall be submitted to the Contracting Officer at least 14 days prior to start of construction.

2.1.1 Coarse Aggregate

Coarse aggregate shall consist of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. The coarse aggregate particles shall meet the following requirements:

a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C 131.

b. The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C 88 using magnesium sulfate.

c. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.

d. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20 percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D 4791.

e. Slag shall be air-cooled, blast furnace slag, and shall have a compacted weight of not less than 75 lb/cu ft when tested in accordance with ASTM C 29/C 29M.

2.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles. The aggregate particles shall be free from coatings of clay, silt, or any objectionable material and shall contain no clay balls. The fine aggregate particles shall meet the following requirements:

- a. The quantity of natural sand (noncrushed material) added to the aggregate blend shall not exceed 15 percent by weight of total aggregate.
- b. The individual fine aggregate sources shall have a sand equivalent value greater than 45 when tested in accordance with ASTM D 2419.
- c. The fine aggregate portion of the blended aggregate shall have an uncompacted void content greater than 45.0 percent when tested in accordance with ASTM C 1252 Method A.

2.1.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D 242.

2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table 2, when tested in accordance with ASTM C 136 and ASTM C 117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

Table 2. Aggregate Gradations

	Gradation 1	Gradation 2	Gradation 3
Sieve Size, inch	Percent Passing by Mass	Percent Passing by Mass	Percent Passing by Mass
1	100	---	---
3/4	76-96	100	---
1/2	68-88	76-96	100
3/8	60-82	69-89	76-96
No. 4	45-67	53-73	58-78
No. 8	32-54	38-60	40-60
No. 16	22-44	26-48	28-48
No. 30	15-35	18-38	18-38
No. 50	9-25	11-27	11-27
No. 100	6-18	6-18	6-18
No. 200	3-6	3-6	3-6

2.2 ASPHALT CEMENT BINDER

Asphalt cement binder shall conform to AASHTO MP 1 Performance Grade (PG) 64-22. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Contracting Officer. The supplier is defined as the last source of any modification to the binder. The Contracting Officer may sample and test the binder at the mix plant at any time before or during mix production. Samples for this verification testing shall be obtained by the Contractor in accordance with ASTM D 140 and in the presence of the Contracting Officer. These samples shall be

furnished to the Contracting Officer for the verification testing, which shall be at no cost to the Contractor. Samples of the asphalt cement specified shall be submitted for approval not less than 14 days before start of the test section.

2.3 MIX DESIGN

The Contractor shall develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). No hot-mix asphalt for payment shall be produced until a JMF has been approved. The hot-mix asphalt shall be designed using procedures contained in AI MS-2 and the criteria shown in Table 3. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867/D 4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. If an antistrip agent is required, it shall be provided by the Contractor at no additional cost. Sufficient materials to produce 200 pound of blended mixture shall be provided to the Contracting Officer for verification of mix design at least 14 days prior to construction of test section.

2.3.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

- a. Percent passing each sieve size.
- b. Percent of asphalt cement.
- c. Percent of each aggregate and mineral filler to be used.
- d. Asphalt viscosity grade, penetration grade, or performance grade.
- e. Number of blows of hammer per side of molded specimen.
- f. Laboratory mixing temperature.
- g. Lab compaction temperature.
- h. Temperature-viscosity relationship of the asphalt cement.
- i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.
- j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.
- k. Specific gravity and absorption of each aggregate.
- l. Percent natural sand.
- m. Percent particles with two or more fractured faces (in coarse

aggregate).

- n. Fine aggregate angularity.
- o. Percent flat or elongated particles (in coarse aggregate).
- p. Tensile Strength Ratio.
- q. Antistrip agent (if required) and amount.
- r. List of all modifiers and amount.

Table 3. Marshall Design Criteria

Test Property	75 Blow Mix	50 Blow Mix
Stability, pounds minimum	*2150	*1350
Flow, 0.01 inch	8-16	8-18
Air voids, percent	3-5	3-5
Percent Voids in mineral aggregate (minimum)	See Table 4	See Table 4
TSR, minimum percent	75	75

* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.

Table 4. Minimum Percent Voids in Mineral Aggregate (VMA)**

Aggregate (See Table 2)	Minimum VMA, percent
Gradation 2	14.0
Gradation 3	15.0

** Calculate VMA in accordance with AI MS-2, based on ASTM D 2726 bulk specific gravity for the aggregate.

2.3.2 Adjustments to JMF

The JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new mix design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the JMF within the limits specified below to optimize mix volumetric properties. Adjustments to the JMF shall be limited to plus or minus 3 percent on the 1/2 inch, No. 4, and No. 8 sieves; plus or minus 1.0 percent on the No. 200 sieve; and plus or minus 0.40 percent binder content. If adjustments are needed that exceed these limits, a new mix design shall be developed. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 2; this is acceptable.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

The asphalt cement material shall be heated avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 325 degrees F when added to the aggregates. Modified asphalts shall be no more than 350 degrees F when added to the aggregates.

3.2 PREPARATION OF MINERAL AGGREGATE

The aggregate for the mixture shall be heated and dried prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D 1461.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, the underlying course shall be cleaned of dust and debris. A prime coat shall be applied in accordance with the contract specifications.

3.5 TEST SECTION

Prior to full production, the Contractor shall place a test section for each JMF used. The contractor shall construct a test section 250 - 500 feet long and two paver passes wide placed in two lanes, with a longitudinal cold joint. The test section shall be of the same depth as the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section shall be the same equipment to be used on the remainder of the course represented by the test section. The test section shall be placed as part of the project pavement as approved by the Contracting Officer.

3.5.1 Sampling and Testing for Test Section

One random sample shall be taken at the plant, triplicate specimens compacted, and tested for stability, flow, and laboratory air voids. A portion of the same sample shall be tested for theoretical maximum density (TMD), aggregate gradation and asphalt content. Four randomly selected cores shall be taken from the finished pavement mat, and four from the longitudinal joint, and tested for density. Random sampling shall be in accordance with procedures contained in ASTM D 3665. The test results shall be within the tolerances shown in Table 5 for work to continue. If all test results meet the specified requirements, the test section shall remain as part of the project pavement. If test results exceed the tolerances shown, the test section shall be removed and replaced at no cost to the Government Owner and another test section shall be constructed.

Table 5. Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	
No. 4 and larger	JMF plus or minus 8
No. 8, No. 16, No. 30, and No. 50	JMF plus or minus 6
No. 100 and No. 200	JMF plus or minus 2.0
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	[13] [14] [15] minimum
Stability, pounds (Average of 3 specimens)	[1350] [2150] minimum
Flow, 0.01 inches (Average of 3 specimens)	[8 - 16] [8 - 18]
Mat Density, Percent of TMD (Average of 4 Random Cores)	93.0 - 96.5
Joint Density, Percent of TMD (Average of 4 Random Cores)	91.5 - 96.5

3.5.2 Additional Test Sections

If the initial test section should prove to be unacceptable, the necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Full production shall not begin until an acceptable section has been constructed and accepted.

3.6 TESTING LABORATORY

The laboratory used to develop the JMF and for Government Engineer acceptance testing shall meet the requirements of ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted

to the Contracting Officer prior to the start of construction. The certification shall contain as a minimum:

- a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.
- b. A listing of equipment to be used in developing the job mix.
- c. A copy of the laboratory's quality control system.
- d. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

The hot-mix asphalt shall be transported from the mixing plant to the site in clean, tight vehicles. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F. To deliver mix to the paver, the Contractor shall use a material transfer vehicle which shall be operated to produce continuous forward motion of the paver.

3.7.2 Placing

The mix shall be placed and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, the mixture shall be placed to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.8 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be compacted as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor, with the exception that the Contractor shall not apply more than three passes with a vibratory roller in the vibrating mode. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any

displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.9 JOINTS

The formation of joints shall be made ensuring a continuous bond between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

The roller shall not pass over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. The cutback material shall be removed from the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Longitudinal joints which are irregular, damaged, uncompacted, cold (less than 175 degrees F at the time of placing the adjacent lane), or otherwise defective, shall be cut back a minimum of 2 inches from the edge with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All contact surfaces shall be given a light tack coat of asphalt material prior to placing any fresh mixture against the joint. The Contractor will be allowed to use an alternate method if it can be demonstrated that density, smoothness, and texture can be met.

3.10 CONTRACTOR QUALITY CONTROL

3.10.1 General Quality Control Requirements

The Contractor shall develop an approved Quality Control Plan. Hot-mix asphalt for payment shall not be produced until the quality control plan has been approved. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

- a. Mix Design
- b. Aggregate Grading
- c. Quality of Materials

- d. Stockpile Management
- e. Proportioning
- f. Mixing and Transportation
- g. Mixture Volumetrics
- h. Moisture Content of Mixtures
- i. Placing and Finishing
- j. Joints
- k. Compaction
- l. Surface Smoothness

3.10.2 Testing Laboratory

The Contractor shall provide a fully equipped asphalt laboratory located at the plant or job site. The effective working area of the laboratory shall be a minimum of 150 square feet with a ceiling height of not less than 7.5 feet. Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 75 degrees F plus or minus 5 degrees F. Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The Contracting Officer shall be permitted unrestricted access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

3.10.3 Quality Control Testing

The Contractor shall perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow, in-place density, grade and smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

3.10.3.1 Asphalt Content

A minimum of one test to determine asphalt content will be performed 200 tons by one of the following methods: extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53, ASTM D 6307, or the nuclear method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the

asphalt content for the mixture.

3.10.3.2 Gradation

Aggregate gradations shall be determined a minimum of once per 200 tons from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

3.10.3.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.10.3.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

3.10.3.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per lot in accordance with ASTM D 1461 or an approved alternate procedure.

3.10.3.6 Laboratory Air Voids, Marshall Stability and Flow

Mixture samples shall be taken at least once per 200 tons and compacted into specimens, using 75blows per side with the Marshall hammer as described in ASTM D 1559. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

3.10.3.7 In-Place Density

The Contractor shall conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D 2950.

3.10.3.8 Grade and Smoothness

The Contractor shall conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT.

3.10.3.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.10.3.10 QC Monitoring

The Contractor shall submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control

testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.10.4 Sampling

When directed by the Contracting Officer, the Contractor shall sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.10.5 Control Charts

For process control, the Contractor shall establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 6, as a minimum. These control charts shall be posted as directed by the Contracting Officer and shall be kept current at all times. The control charts shall identify the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 6 applicable to the test parameter being plotted, and the Contractor's test results. Target values from the JMF shall also be shown on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, the Contractor shall take immediate steps to bring the process back in control. When the test results exceed either applicable Suspension Limit, the Contractor shall halt production until the problem is solved. The Contractor shall use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Decisions concerning mix modifications shall be made based on analysis of the results provided in the control charts. The Quality Control Plan shall indicate the appropriate action which shall be taken to bring the process into control when certain parameters exceed their Action Limits.

Table 6. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

Parameter to be Plotted	Individual Samples		Running Average of Last Four Samples	
	Action Limit	Suspension Limit	Action Limit	Suspension Limit
No. 4 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	6	8	4	5
No. 30 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	4	6	3	4
No. 200 sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	1.4	2.0	1.1	1.5
Stability, pounds (minimum)				

Table 6. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

Parameter to be Plotted	Individual Samples		Running Average of Last Four Samples	
	Action Limit	Suspension Limit	Action Limit	Suspension Limit
75 blow JMF	1760	1640	2150	2030
50 blow JMF	950	830	1350	1230
Flow, 0.01 inches				
75 blow JMF	8 min. 16 max.	7 min. 17 max.	9 min. 15 max.	8 min. 16 max.
50 blow JMF	8 min. 18 max.	7 min. 19 max.	9 min. 17 max.	8 min. 18 max.
Asphalt content, % deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, % deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Mat Density, % of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, % of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			

3.11 MATERIAL ACCEPTANCE AND PERCENT PAYMENT

The Contractor's quality assurance (QA) program for this project, specified below, will be separate and distinct from the Contractor's quality control (QC) program specified above. Testing for acceptability of work will be performed by the Contractor or by an independent laboratory hired by the Contracting Officer, except for grade and smoothness testing which shall be performed by the Contractor. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. A standard lot for all requirements will be equal to 2000 short tons. Where appropriate, adjustment in payment for individual lots of hot-mix asphalt will be made based on in-place density, laboratory air voids, grade and smoothness in accordance with the following paragraphs. Grade and surface smoothness determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus grade and smoothness measurements for the entire lot cannot be made. In order to evaluate laboratory air voids and in-place (field) density, each lot will be divided into four equal sublots.

3.11.1 Percent Payment

When a lot of material fails to meet the specification requirements for 100

percent pay as outlined in the following paragraphs, that lot shall be removed and replaced.

3.11.2 Sublot Sampling

One random mixture sample for determining laboratory air voids, theoretical maximum density, and for any additional testing the Contracting Officer desires, will be taken from a loaded truck delivering mixture to each sublot, or other appropriate location for each sublot. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D 3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D 1559. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

3.11.3 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.11.4 Laboratory Air Voids and Theoretical Maximum Density

Laboratory air voids will be calculated in accordance with ASTM D 3203 by determining the Marshall density of each lab compacted specimen using the laboratory-prepared, thoroughly dry method in ASTM D 2726 and determining the theoretical maximum density (TMD) of every other sublot sample using ASTM D 2041. Laboratory air void calculations for each sublot will use the latest theoretical maximum density values obtained, either for that sublot or the previous sublot. The mean absolute deviation of the four laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated and a pay factor determined from Table 7. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot. The TMD is also used for computation of compaction, as required in paragraph: Mat and Joint Densities.

3.11.5 Mean Absolute Deviation

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 random samples of a lot (where 3 specimens were compacted from each sample). The average laboratory air voids for each sublot sample are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

$$\text{Mean Absolute Deviation} = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 - 4.0|)/4$$

$$= (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45$$

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen from Table 7 that the lot's pay factor based on laboratory air voids, is 100 percent.

Table 7. Pay Factor Based on Laboratory Air Voids

Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, %
0.60 or less	100
Above 0.61	Reject (0)

3.11.6 In-place Density

3.11.6.1 General Density Requirements

For determining in-place density, one random core (4 inches or 6 inches in diameter) will be taken by the Government from the mat (interior of the lane) of each subplot, and one random core will be taken from the joint (immediately over joint) of each subplot. Each random core will be full thickness of the layer being placed. When the random core is less than 1 inch thick, it will not be included in the analysis. In this case, another random core will be taken. After air drying in accordance with ASTM D 2726 for laboratory-prepared, thoroughly dry specimens, cores obtained from the mat and from the joints will be used for in-place density determination.

3.11.6.2 Mat and Joint Densities

The average in-place mat and joint densities are expressed as a percentage of the average TMD for the lot. The average TMD for each lot will be determined as the average TMD of the two random samples per lot. The average in-place mat density and joint density for a lot are determined and compared with Table 8 to calculate a single pay factor per lot based on in-place density, as described below. First, a pay factor for both mat density and joint density are determined from Table 8. The area associated with the joint is then determined and will be considered to be 10 feet wide times the length of completed longitudinal construction joint in the lot. This area will not exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of hot-mix asphalt pavement, either an adjacent freshly paved lane or one paved at any time previously. The area associated with the joint is expressed as a percentage of the total lot area. A weighted pay factor for the joint is determined based on this percentage (see example below). The pay factor for mat density and the weighted pay factor for joint density is compared and the lowest selected. This selected pay factor is the pay factor based on density for the lot. When the TMD on both sides of a longitudinal joint is different, the average of these two TMD will be used as the TMD needed to calculate the percent joint density. All density results for a lot will be completed and reported within 24 hours after the construction of that lot.

Table 8. Pay Factor Based on In-place Density

Average Mat Density (4 Cores)	Pay Factor, %	Average Joint Density (4 Cores)
94.0 - 96.0	100.0	Above 92.5
93.9	100.0	92.4
Below 93.8 or Above 96.1	0.0 (Reject)	Below 92.4

Table 8. Pay Factor Based on In-place Density

Average Mat Density (4 Cores)	Pay Factor, %	Average Joint Density (4 Cores)

3.11.7 Grade

Within 5 working days after completion of a particular lot incorporating the final earing course, the Contractor shall test the final wearing surface of the pavement for conformance with specified plan grade requirements. All testing shall be performed in the presence of the Contracting Officer. The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 0.03 foot for runways or 0.05 foot for taxiways and aprons from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The grade will be determined by running lines of levels at intervals of 25 feet, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface.

Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. When more than 5 percent of all measurements made within a lot are outside the 0.03 or 0.05 foot tolerance, the Contractor shall remove the surface lift full depth; the Contractor shall then replace the lift with hot-mix asphalt to meet specification requirements, at no additional cost to the Government Owner. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

3.11.8 Surface Smoothness

The Contractor shall use both of the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all longitudinal and transverse testing, except where the runs would be less than 200 feet in length and the ends where the straightedge shall be used.

Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

3.11.8.1 Smoothness Requirements

a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavements shall be within the tolerances specified in Table 9 when checked with an approved 12 foot straightedge.

Table 9. Straightedge Surface Smoothness--Pavements

Pavement Category -----	Direction of Testing -----	Tolerance, inches -----
Runways and taxiways	Longitudinal	1/8
	Transverse	1/4
Calibration hardstands and compass swinging bases	Longitudinal	1/8
	Transverse	1/8
All other airfields and helicopter paved areas	Longitudinal	1/4
	Transverse	1/4

b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavement shall have a Profile Index not greater than specified in Table 10 when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 200 feet, that direction shall be tested by the straightedge method and shall meet requirements specified above.

Table 10. Profilograph Surface Smoothness--Pavements

Pavement Category -----	Direction of Testing -----	Maximum Specified Profile Index (inch/mile) -----
Runways	Longitudinal	7
	Transverse	9
Taxiways	Longitudinal	9
	Transverse	(Use Straightedge)
Calibration Hardstands & Compass Swinging Bases		(Use Straightedge)
All Other Airfield & Helicopter Paved Areas	Longitudinal	9
	Transverse	9

3.11.8.2 Testing Method

After the final rolling, but not later than 24 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 15 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lines less than 20 feet and at the third points for lanes 20 feet or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints.

a. Straightedge Testing. The straightedge shall be held in contact

with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

b. Profilograph Testing. Profilograph testing shall be performed using approved equipment and procedures described in CDT Test 526. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. The "blanking band" shall be 0.2 inches wide and the "bump template" shall span 1 inch with an offset of 0.4 inch. The profilograph shall be operated by an approved, factory-trained operator on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing.

3.11.8.3 Payment Adjustment for Smoothness

a. Straightedge Testing. Location and deviation from straightedge for all measurements shall be recorded. When [AM#2] greater than 5.0 [AM#2] _____ percent of all measurements made within a lot exceed the tolerance specified in paragraph Smoothness Requirements above, after any reduction of high spots or removal and replacement, [AM#2] _____ the lot shall be removed and replaced at no additional cost to the GovernmentOwner. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent, shall be corrected by diamond grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the GovernmentOwner.

b. Profilograph Testing. Location and data from all profilograph measurements shall be recorded. When the Profile Index of a lot exceeds the tolerance specified in paragraph Smoothness Requirements above by 1.0 inch/mile, but less than 2.0 inches/mile, after any reduction of high spots or removal and replacement, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 5.0 inches/mile or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

c. Bumps ("Must Grind" Areas). Any bumps ("must grind" areas) shown on the profilograph trace which exceed 0.4 inch in height shall be reduced by diamond grinding until they do not exceed 0.3 inch when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. The following will not be permitted: (1) skin patching for correcting low areas, (2) planing or milling for correcting high areas. At the Contractor's option, pavement areas, including ground areas, may be rechecked with the profilograph in order to record a lower Profile Index.

-- End of Section --

SECTION 02753A

CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY-DUTY PAVEMENTS

01/02

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1 (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

ACI 214.3R (1988; R 1997) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete

ACI 305R (1999) Hot Weather Concreting

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182 (1991; R 1996) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 184/A 184M (2001) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

ASTM A 185 (1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 497 (1999) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

ASTM A 53/A 53M (2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 615/A 615M (2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 616/A 616M (1996a) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A 617/A 617M (1996a) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM C 1064/C 1064M	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	(1998) Lightweight Particles in Aggregate
ASTM C 1240	(2000) Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar and Grout
ASTM C 1260	(1994) Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1978; R 1997) Clay Lumps and Friable Particles in Aggregates
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 174/C 174M	(1997) Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregates
ASTM C 295	(1998) Petrographic Examination of Aggregates for Concrete
ASTM C 31/C 31M	(2000e1) Making and Curing Concrete Test Specimens in the Field

ASTM C 33	(1999ae1) Concrete Aggregates
ASTM C 330	(2000) Lightweight Aggregates for Structural Concrete
ASTM C 39/C 39M	(2001) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 470/C 470M	(1998) Molds for Forming Concrete Test Cylinders Vertically
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 595	(2000a) Blended Hydraulic Cements
ASTM C 595M	(1997) Blended Hydraulic Cements (Metric)
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM C 989	(1999) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 1227	(1995) Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 3665	(1999) Random Sampling of Construction Materials
ASTM D 449	(1989; R 1999e1) Asphalt Used in Dampproofing and Waterproofing
ASTM D 946	(1982; R 1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1997) NIST Handbook 44: Specifications, Tolerances, and other Technical Requirements for Weighing and Measuring Devices
NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)	
NRMCA CPMB 100	(1996) Concrete Plant Standards \n/c\$\X
STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)	
CDT Test 526	(1978) Operation of California Profilograph and Evaluation of Profiles
U.S. ARMY CORPS OF ENGINEERS (USACE)	
COE CRD-C 100	(1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 114	(1997) Test Method for Soundness of Aggregates by Freezing and Thawing of Concrete Specimens
COE CRD-C 119	(1991) Standard Test Method for Flat or Elongated Particles in Coarse Aggregate
COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 143	(1962) Specifications for Meters for Automatic Indication of Moisture in Fine Aggregate
COE CRD-C 171	(1995) Test Method for Determining Percentage of Crushed Particles in Aggregate
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 55	(1992) Test Method for Within-Batch Uniformity of Freshly Mixed Concrete

COE CRD-C 572

(1974) Corps of Engineers Specifications for
Polyvinylchloride Waterstop

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441/20

(Rev. A) Paint, Epoxy-Polyamide, Green
Primer, Formula 150, Type III

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G

- a. Details and data on the batching and mixing plant prior to plant assembly including manufacturer's literature showing that the equipment meets all requirements specified herein.
- b. A description of the equipment proposed for transporting concrete mixture from the central mixing plant to the paving equipment at least 7 days prior to start of paving unless otherwise specified.
- c. At the time the materials are furnished for the mixture proportioning study, a description of the equipment proposed for the placing of the concrete mixture, method of control, and manufacturer's literature on the paver and finisher, together with the manufacturer's written instructions on adjustments and operating procedures necessary to assure a tight, smooth surface on the concrete pavement, free of tears and other surface imperfections, including excessive paste on the surface. The literature shall show that the equipment meets all details of these specifications.

Proposed Techniques; G

- a. A description of the placing and protection methods proposed prior to construction of the test section, if concrete is to be placed in or exposed to hot or cold weather conditions.
- b. A detailed plan of the proposed paving pattern showing all planned construction joints. No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Ft. Worth District Military Design Branch .
- c. Data on the curing media and methods to be used.

Samples for Mixture Proportioning Studies; G

The results of the Contractor's mixture proportioning studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of concrete at least 14 days prior to commencing concrete placing operations. Aggregate quantities shall be based on the mass in a saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, inspected by the Government, and approved in writing, showing that mixture proportioning studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

Delivery, Storage, and Handling of Materials;

Copies of waybills or delivery tickets for cementitious material during the progress of the work. Before the final payment is allowed, waybills and certified delivery tickets shall be furnished for all cementitious material used in the construction.

SD-06 Test Reports

Sampling and Testing;G

Certified copies of laboratory test reports, including all test data, for cement, pozzolan, aggregate, admixtures, steel reinforcement, epoxy, and curing compound proposed for use on this project. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials. No material shall be used until notice of acceptance has been given. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

1.3 MEASUREMENT AND PAYMENT (AM#2)

1.3.1 Measurements (Am#2)

1.3.1.1 Concrete

The quantity of concrete to be paid for will be the volume of concrete in cubic meters including monolithic curb, where required, placed in the completed and accepted pavement. Concrete will be measured in place in the completed and accepted pavement only within the neat line dimensions shown in the plan and cross section. No deductions will be made for rounded or beveled edges or the space occupied by pavement reinforcement, dowel bars, tie bars, or electrical conduits, nor for any void, or other structure extending into or through the pavement slab, measuring 0.1 cubic meter or less in volume. No other allowance for concrete will be made unless placed in specified locations in accordance with written instructions previously issued by the Contracting Officer. THE CONCRETE COVERED BY THIS SPECIFICATION IS THE AIRCRAFT PARKING APRON, CONCRETE PAVEMENT AT DEPLOYMENT CENTER (SEQ# CA102), AND THE CONCRETE PAVEMENT ON THE AMMO. UPLOAD ROAD AND PAD.

1.3.1.2 Mixture Proportions By Contractor

The Contractor shall be responsible for the mixture proportions of cementitious materials and chemical admixtures; no separate measurement or payment will be made for any cementitious material, including pozzolan, or for any chemical admixture.

1.3.1.3 Steel Reinforcement

Fabricated steel bar mats or welded steel wire fabric for reinforcement will not be measured for payment but will be considered as a subsidiary obligation of the Contractor, covered under the price per cubic meter for concrete.

1.3.1.4 Dowels and Tie Bars

The quantity of dowels and tie bars used in the work will not be measured for payment but will be considered as a subsidiary obligation of the Contractor, covered under the price per cubic meter for concrete.

1.3.1.5 Joint Materials

The quantity of expansion joint filler will not be measured for payment but will be considered as a subsidiary obligation of the Contractor, covered under the price per cubic meter for concrete. Joint sealing materials are covered in Section 02760A FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

1.3.2 Payments (Am#2)

1.3.2 Concrete

The quantity of concrete measured as specified above will be paid for at the contract unit price when placed in completed and accepted pavements. Payment shall be made at the contract price for cubic meter for the scheduled item, with necessary adjustments as specified in paragraph ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS. Payment will constitute full compensation for furnishing all materials, equipment, plant and tools, and for all labor and other incidentals necessary to complete the concrete pavement.

1.4 ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS

Concrete samples shall be taken by the Contractor in the field to determine the slump, air content, and strength of the concrete. Test beams and test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. Any pavement not meeting the requirement for 'specified strength' shall be removed and replaced at no additional cost to the Government. The air content shall be determined in accordance with ASTM C 231. Slump tests shall be made in accordance with ASTM C 143/C 143M. Test beams shall be molded and cured in accordance with ASTM C 31/C 31M and as specified below. Steel molds shall be used for molding the beams specimens. Molds for cylinder test specimens shall conform to ASTM C 470/C 470M. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and

protecting test specimens at the site and in the laboratory. Laboratory curing facilities for test specimens shall include furnishing and operating water tanks equipped with temperature-control devices that will automatically maintain the temperature of the water at 73 plus or minus 5 degrees F. The Contractor shall furnish and maintain at the site boxes or other facilities suitable for storing the specimens while in the mold at a temperature of 73 plus or minus 10 degrees F. Tests of the fresh concrete and of the hardened concrete specimens shall be made by and at the expense of the Contractor.

1.4.1 [AM#2] DELETED

1.4.2 [AM#2] DELETED

1.4.3 Evaluation

The Contractor shall provide facilities for and, where directed, personnel to assist in obtaining samples for any Government testing, all at no additional cost to the Government. Such testing will in no way relieve the Contractor of any specified testing responsibilities. The Contractor shall provide all sampling and testing required for acceptance and payment adjustment at its expense. Such sampling and testing shall be performed by a commercial testing laboratory inspected by the Government and approved in writing. The laboratory performing the tests shall be on-site and shall conform with **ASTM C 1077**. The individuals who sample and test concrete or the constituents of concrete as required in this specification shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I, or shall have otherwise demonstrated to the satisfaction of the Contracting Officer other training providing knowledge and ability equivalent to the ACI minimum requirements for certification. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II, or have otherwise demonstrated to the satisfaction of the Contracting Officer other training providing knowledge and ability equivalent to the ACI minimum requirements for certification. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with **ASTM C 1077**.

1.4.4 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. Testing in these areas will be in addition to the subplot or lot testing, and the requirements for these areas will be the same as those for a subplot or lot, but shall be at no additional cost to the Government.

1.4.5 Air Content Tests

Air content of the concrete shall be controlled as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and will not be considered for payment adjustment.

1.4.6 Slump Tests

Slump of the concrete shall be controlled as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and will not be considered for payment adjustment.

1.4.7 Surface Smoothness

The Contractor shall use both of the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer's representative. Detailed notes shall be kept of the results of the testing and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all longitudinal and transverse testing, except where the runs would be less than 200 feet in length and at the ends where the straightedge shall be used. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

1.4.7.1 Smoothness Requirements

- a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavements shall be within the limits specified in Table 1 when checked with an approved 12 foot straightedge.

TABLE 1
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Limits Inches
Runways and Taxiways	Longitudinal	1/8
	Transverse	1/4
Calibration Hardstands & Compass Swinging Bases	Longitudinal	1/8
	Transverse	1/8
All Other Airfield and Helicopter Paved Areas	Longitudinal	1/4
	Transverse	1/4
Roads and Streets	Longitudinal	3/16
	Transverse	1/4
Tank Hardstands, Parking Areas, Open Storage Areas	Longitudinal	1/4
	Transverse	1/4

- b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavement shall have a Profile Index not greater than specified in Table 2 when tested with an approved California-type profilograph. If the extent of the pavement lot in either direction is less than 200 feet, that direction shall be tested by the straightedge method and shall meet requirements specified for such.

TABLE 2
PROFILOGRAPH SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Maximum Specified Profile Index Inch per mile
-------------------	-------------------------	-----------------------------------------------------

Runways	Longitudinal	7
	Transverse	9
Taxiways	Longitudinal	9
	Transverse	(Use Straightedge)
Calibration Hardstands and Compass Swinging Bases		(Use Straightedge)
All Other Airfield and Helicopter Paved Areas	Longitudinal	9
	Transverse	9
Roads and Streets	Longitudinal	9
	Transverse	(Use Straightedge)
Tank Hardstands, Parking Areas, Open Storage Areas	Longitudinal	11
	Transverse	11

1.4.7.2 Testing Method

After the concrete has hardened sufficiently to permit walking thereon, but not later than 36 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. However, transverse profilograph testing of multiple paving lanes shall be performed at the timing directed. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 15 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane shown on the drawings, regardless of whether the Contractor is allowed to pave two lanes at a time, and at the 1/8th point in from each side of the lane. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints. Transverse testing lines for pilot lanes shall be carried to construction joint lines and for fill-in lanes shall be carried 24 inches across construction joints, and the readings in this area applied to the fill-in lane. Straightedge testing of the longitudinal edges of slipformed pilot lanes shall also be performed before paving fill-in lanes as specified in paragraph "Edge Slump and Joint Face Deformation".

- a. Straightedge Testing: The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.
- b. Profilograph Testing: Profilograph testing shall be performed using approved equipment and procedures described in [CDT Test 526](#). The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and

the Profile Index for the pavement. The "blanking band" shall be 0.2 inches wide and the "bump template" shall span 1 inch with an offset of 0.4 inch. The profilograph shall be operated by an approved, factory-trained operator on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing.

1.4.7.3 Payment Adjustment for Smoothness

- a. Straightedge Testing: Location and deviation from straightedge for all measurements shall be recorded. When [AM#2] greater than 5.0 [AM#2] _____ percent [AM#2] _____ of all measurements made within a lot exceed the tolerance specified in paragraph "Smoothness Requirements" above, after any reduction of high spots or removal and replacement, [AM#2] _____ the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.
- b. Profilograph Testing: Location and data from all profilograph measurements shall be recorded. When the Profile Index of a lot exceeds the tolerance specified in paragraph "Smoothness Requirements" above by 1.0 inch per mile but less than 2.0 inches per mile, after any reduction of high spots or removal and replacement, [AM#2] _____ the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 5.0 inches per mile or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.
- c. Bumps ("Must Grind" Areas): Any bumps ("must grind" areas) shown on the profilograph trace which exceed 0.4 inch in height shall be reduced by grinding in accordance with subparagraph "Areas Defective In Plan Grade Or Smoothness" until they do not exceed 0.3 inch when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. Areas of textured pavement shall be retextured in accordance with the subparagraph listed above. At the Contractor's option, pavement areas including ground areas may be rechecked with the profilograph in order to record a lower Profile Index.

1.4.8 Edge Slump and Joint Face Deformation

The following requirements on testing and evaluation of edge slump and joint face deformation apply only to pavements 10 inches or more in thickness. Use of slip-form paving equipment and procedures that fail to consistently provide edges within the specified tolerances on edge slump and joint face deformation shall be discontinued and the pavements shall be constructed by means of standard paving procedures using fixed forms. Slabs having more than the allowable edge slump shall be removed and replaced as specified in subparagraph "Excessive Edge Slump" before the adjacent lane is placed.

Edge slump and joint face deformation will not be applied to payment adjustment.

1.4.8.1 Edge Slump

When slip-form paving is used, not more than 15.0 percent of the total free edge of any slab of the pavement, as originally constructed, shall have an edge slump exceeding 1/4 inch, and no slab shall have an edge slump exceeding 3/8 inch as determined in accordance with the measurements as specified in paragraph "Determination of Edge Slump". (The total free edge of the pavement will be considered to be the cumulative total linear measurement of pavement edge originally constructed as non-adjacent to any existing pavement; i.e., 100 feet of pilot lane, a paving lane originally constructed as a separate lane, will have 200 feet of free edge; 100 feet of fill-in lane will have no free edge, etc.,). The area affected by the downward movement of the concrete along the pavement edge shall not exceed 18 inches back from the edge.

1.4.8.2 Joint Face Deformation

In addition to the edge slump limits specified above, the vertical joint face shall have a surface within the maximum limits shown below:

Offset from Straightedge Applied Longitudinally To Pavement Surface 1 Inch Back From Joint Line	Offset From Straightedge Applied Longitudinally to Vertical Face	Offset From Straightedge Applied Top to Bottom Against the Joint Face	Abrupt Offset in Any Direction	Offset of Joint Face From True Vertical	
Airfield Pavement	1/8 inch	1/4 inch	3/8 inch	1/8 inch	1 inch per 12 inches
All other Pavement	1/4 inch	All other items same as airfield pavement.			

1.4.8.3 Determination of Edge Slump

Immediately after the concrete has hardened sufficiently to permit walking thereon, the pavement surface shall be tested by the Contractor in the presence of a representative of the Contracting Officer. Testing shall be performed with a straightedge to reveal irregularities exceeding the edge slump tolerance specified above. The edge slump shall be determined at each free edge of each slipformed paving lane constructed. The straightedge shall be placed transverse to the direction of paving and the end of the straightedge located at the edge of the paving lane. Measurements shall be made at 5 to 15 foot spacings, as directed, commencing at the header where paving was started. Initially measurements shall be made at 5 foot intervals in each lane. When no deficiencies are present, the Contracting Officer may approve an increase in the interval. When any deficiencies exist, the interval will be returned to 5 feet. In no case shall the interval exceed 15 feet. In addition to the transverse edge slump determination above, the Contractor, at the same time, shall check the longitudinal surface smoothness of the joint on a continuous line 1 inch

back from the joint line using the straightedge advanced one-half its length for each reading. Other tests of the exposed joint face shall be made as directed to ensure that a uniform, true vertical joint face is attained. These tests shall include longitudinal straightedge testing of the vertical face and vertical testing of the face for both smoothness and angle. The measurements shall be made by the Contractor, shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Contracting Officer within 24 hours after measurement is made. The report shall also identify areas requiring replacement in accordance with paragraph "Excessive Edge Slump" as well as the cumulative percentage of total free edge of pavement constructed to date which has an edge slump exceeding 1/4 inch.

1.4.8.4 Excessive Edge Slump

When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump or joint deformation shall be removed and replaced in conformance with paragraph REPAIR, REMOVAL, REPLACEMENT OR SLABS. Partial slabs removed and replaced shall extend across the full width of the pavement lane, parallel to the transverse joints, and both the section of the slab removed and the section remaining in place shall have a minimum length of 10 feet to the nearest scheduled transverse joint. If less than 10 feet remains, the entire slab shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

1.4.9 Plan Grade

1.4.9.1 Plan Grade Tolerances

The finished surfaces of pavements shall conform, within the tolerances shown below, to the lines, grades, and cross sections shown. The finished surfaces of airfield and apron pavements shall vary not more than 1/2 inch above or below the plan grade line or elevation indicated. Plan grade shall be checked on the lot as a whole and when more than 5.0 [AM#2] _____ all measurements made within a lot are outside the specified tolerance, [AM#2] _____ the deficient area shall be removed and replaced at no additional cost to the Government. However, the above deviations from the approved grade line and elevation will not be permitted in areas where closer conformance with the planned grade and elevation is required for the proper functioning of appurtenant structures. The finished surfaces of new abutting pavements shall coincide at their juncture.

1.4.9.2 Grade Conformance Tests

Each pavement category shall be checked by the Contractor for conformance with plan grade requirements. For the purpose of making grade conformance tests, the pavements will be subdivided into the same lots used for all other payment adjustment items. Within 5 days after paving of each lot, the finished surface of the pavement area in each lot shall be tested by the Contractor, in the presence of a representative of the Contracting Officer, by running lines of levels at intervals corresponding with every longitudinal and transverse joint to determine the elevation at each joint

intersection. The results of this survey shall be recorded and a copy given to the Government at the completion of the survey of each lot.

1.4.10 Flexural Strength

Each lot of pavement will be evaluated for acceptance in accordance with the following procedures. The Contractor shall be responsible for all testing required herein. Testing shall be performed by an approved commercial laboratory. Results of strength tests will not be used for payment adjustment.

1.4.10.1 Sampling and Testing

One composite sample of concrete from each subplot shall be obtained in accordance with **ASTM C 172** from one batch or truckload. Test beams, 6 x 12 in. shall be fabricated and cured in accordance with **ASTM C 31/C 31M**; and tested in accordance with **ASTM C 78**. Two test beams per subplot (8 per lot) shall be fabricated and cured for flexural strength, and two tested at 14-day age and two at 28-day age. The remaining four shall be tested at the ages directed. At the same time 2 additional test beams per subplot to be used for CQC tests shall be fabricated and cured; and tested as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL. Two beams for flexural strength shall be fabricated and cured in accordance with **ASTM C 31/C 31M** and tested in accordance with **ASTM C 78** for every 2500 cubic yards of concrete. These shall be tested at the ages directed.

1.4.11 Thickness

Each lot of pavement will be evaluated for acceptance and payment adjustment in accordance with the following procedure. The Contractor shall be responsible for drilling the cores, measuring the cores in the presence of the Contracting Officer's representative, and for filling the core holes as directed.

1.4.11.1 Drilling, Measuring, and Computations

Two cores, between 3 and 6 in. in diameter, shall be drilled from the pavement, per subplot (8 per lot). The Contractor shall fill the core holes with concrete containing an expanding admixture, as directed. The cores shall be evaluated for thickness of the pavement in accordance with **ASTM C 174/C 174M**. The pavement thickness from the 8 cores for the lot shall be averaged.

1.4.11.2 Evaluation and Payment Adjustment for Thickness

Using the Average Thickness of the lot, the computed percent payment for thickness shall be determined by entering the following table:

Pavements Over 8 inches In Thickness

Deficiency in Thickness Determined by Cores Inches	Computed Percent Payment for Thickness

0.00 to 0.24	100
0.25 to 0.49	75
0.50 to 0.74	50
0.75 or greater	0

Pavements 8 inches or Less In Thickness

Deficiency in Thickness Determined by Cores Inches	Computed Percent Payment for Thickness
0.00 to 0.24	100
0.25 to 0.49	65
0.50 or greater	0

Where 0 percent payment is indicated, the entire lot shall be removed and replaced at no additional cost to the Government. Where either of the two cores from a subplot show a thickness deficiency of 0.75 inch or greater, two more cores shall be drilled in the subplot and the average thickness of the four cores computed. If this average shows a thickness deficiency of 0.75 inch or more 0.50 inch for pavements 8 inches or less in thickness the entire subplot shall be removed.

1.4.12 Partial Lots

When operational conditions cause a lot to be terminated before the specified four sublots have been completed, the following procedure shall be used to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they shall constitute a lot and acceptance criteria adjusted accordingly. Where one or two sublots have been completed, they shall be incorporated into the next lot or the previous lot, as directed, and the total number of sublots shall be used and acceptance criteria adjusted accordingly.

1.4.13 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced either by hand rubbing the freshly finished concrete with a silicon carbide brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 14 days or more old. Rubbing with a silicon carbide brick and water shall be discontinued as soon as contact with the coarse aggregate is made, and all further necessary reduction shall be accomplished by grinding the hardened concrete with a surface-grinding machine after it is 14 days old. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and shall not exceed 1 percent of the total area of any subplot. The depth of grinding shall not exceed 1/4 inch. All pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified above, shall be removed and replaced in conformance with paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS. All areas in which rubbing or grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any rubbing or grinding performed on individual slabs with

excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

1.5 ACCEPTABILITY OF WORK

The materials and the pavement itself will be accepted on the basis of tests made by the Government and by the Contractor's approved commercial laboratory or the supplier's approved laboratory, all as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. If the results of the Government and Contractor tests vary by less than 2.0 percent, of the Government's test results, the results of the Contractor's tests will be used. If the results of the Government and Contractor tests vary by 2.0 percent or more, but less than 4.0 percent, the average of the two will be considered the value to be used. If these vary by 4.0 percent or more, each sampling and testing procedure shall be carefully evaluated and both the Government and the Contractor shall take another series of tests on duplicate samples of material. If these vary by 4.0 percent or more, the results of the tests made by the Government shall be used and the Government will continue check testing of this item on a continuous basis until the two sets of tests agree within less than 4.0 percent on a regular basis. Testing performed by the Government will in no way at any time relieve the Contractor from the specified testing requirements.

1.6 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples.

1.6.1 Aggregates

Aggregates shall be sampled by the Contractor in the presence of a Government representative. Samples shall be obtained in accordance with COE CRD-C 100 and of the size indicated therein, or larger if specified in paragraph Testing Sequence Deleterious Materials -- Airfields Only and shall be representative of the materials to be used for the project. Samples shall be delivered by the Contractor to the US Army Corps of Engineers, Materials Testing Center, Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, Mississippi, 39180-6199, at least 60 days prior to start of construction. The amount of materials to be delivered for testing shall be as follows:

Material	Size	Quantity
Course Aggregate	38-19mm	227kg
Course Aggregate	19-4.75mm	227kg
Fine Aggregate	minus 4.75mm	45kg

Samples of aggregate will be tested by the Government to determine compliance with these specifications. No material shall be used unless test results show that it meets all requirements of these specifications.

1.6.2 Chemical Admixtures

The Contractor shall provide satisfactory facilities for ready procurement of adequate test samples. All sampling and testing of an admixture will be

by/at the expense of the [AM#2] Contractor. Tests will be conducted with materials proposed for the project. An air-entraining admixture that has been in storage at the project site for longer than 6 months or that has been subjected to freezing will be retested at the expense of the Contractor when considered appropriate and shall be rejected if test results are not satisfactory.

1.6.3 Curing Compound

The Contractor shall provide satisfactory facilities for ready procurement of adequate test samples. The sampling and testing will be by and at the expense of the Contractor. Tests will be conducted with materials proposed for the project and shall be certified by the manufacturer.

1.6.4 Epoxy-Resin Material

At least 30 days before the material is used, the Contractor shall submit certified copies of test results showing that the specific lots or batches from which the material will be furnished to this project have been tested by the manufacturer and that the material conforms to the requirements of these specifications. When epoxy resin arrives at the job site, the Contractor shall assist the Government to sample the material. The Government will test the sample or will retain it in storage for possible future testing, as considered appropriate.

1.6.5 Cements and Pozzolans

Preconstruction sampling and testing of cement and pozzolan shall conform to the requirements specified for sampling and testing during construction except that test results showing that each material meets specification requirements shall be available at least 15 days before start of paving operations.

1.7 TESTING BY CONTRACTOR DURING CONSTRUCTION

1.7.1 Contractor's Testing Requirements

During construction, the Contractor shall be responsible for sampling and testing aggregates, cementitious materials (cement and pozzolan), and concrete to determine compliance with the specifications. All sampling and testing shall be performed by an approved commercial laboratory, or for cementitious materials, the manufacturer's laboratory. Samples of aggregate shall be obtained as the bins discharge into the weigh hopper. Samples of concrete shall be obtained at the point of delivery to the paver. The Government will sample and test concrete and ingredient materials as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Testing by the Government will in no way relieve the Contractor of the specified testing requirements.

1.7.2 Cementitious Materials

Cement and pozzolan will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports showing that the material in each shipment meets the requirements of the specification under which it is furnished. No cementitious material shall be used until notice of acceptance has been given by the Contracting Officer.

Cementitious material may be subjected to check testing by the Government from samples obtained at the mill, at transfer points, or at the project site.

1.8 TESTING BY GOVERNMENT DURING CONSTRUCTION

1.8.1 Government Testing

During construction, the Government will be responsible for sampling and testing aggregates, cementitious materials (cement and pozzolan), and concrete to determine compliance with the specifications. Samples of aggregate will be obtained as the bin discharges into the weigh hopper. Samples of concrete will be obtained at the point of delivery to the paver. The Government will sample and test concrete and ingredient materials as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Testing by the Government will in no way relieve the Contractor of the specified testing requirements.

1.9 QUALIFICATIONS

All Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades (or shall have approved written evidence of having completed similar qualification programs):

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

The foreman or lead journeyman of the finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher, or equal. Written documentation shall be furnished for each workman in the above groups.

1.10 TEST SECTION

At least 10 days but not more than 60 days prior to construction of the concrete pavement, a test section shall be constructed as part of the production paving area at an outer edge as indicated on the drawings. If part of the production paving area, the test section will be allowed to remain in place, if meeting all specification requirements and will be paid for as part of the production pavement. There will be no separate payment for the test section or sections and the cost of the materials, and the construction will be considered a subsidiary cost of constructing the project. The Contractor shall notify the Contracting Officer at least 5 days in advance of the date of test section construction. The test section shall consist of one paving lane at least 400 feet long and shall be constructed to a thickness inches. The lane width shall be the same as that required for use in the project. The test section shall contain at least one transverse construction joint. If keyed or doweled longitudinal construction joints are required in any of the production pavements, they shall be installed full length along one side of the test strip throughout the test section. If both keys and dowels are required, each shall be installed in half of the test section. Two separate days shall be used for construction of the test section. The Contractor shall use the test section

to develop and demonstrate to the satisfaction of the Contracting Officer the proposed techniques of mixing, hauling, placing, consolidating, finishing, curing, start-up procedures, testing methods, plant operations, and the preparation of the construction joints. Variations in mixture proportions other than water shall be made if directed. The test section shall be placed as approved by the Government. The Contractor shall vary the water content, as necessary, to arrive at the appropriate content. The mixing plant shall be operated and calibrated prior to start of placing the test section. The Contractor shall use the same equipment, materials, and construction techniques on the test section as will be used in all subsequent work. Base course preparation, concrete production, placing, consolidating, curing, construction of joints, and all testing shall be in accordance with applicable provisions of this specification. The Contractor shall construct the test section meeting all specification requirements and being acceptable to the Contracting Officer in all aspects, including surface texture. Failure to construct an acceptable test section will necessitate construction of additional test sections at no additional cost to the Government. Any test sections unacceptable to the Contracting Officer shall be removed at the Contractor's expense. If the Contractor proposes to use slipform paving and is unable to construct an acceptable test section, or if the slipform paving equipment and procedures are found to be unable to produce acceptable pavement at any time, the slipform paving equipment shall be removed from the job and the construction completed using stationary side forms and equipment compatible with them. The Contractor shall provide four cores at least 6 inch diameter full depth from points selected in the test section by the Government, 5 days after completion of the test section. The Contractor shall deliver the cylinders for visual inspection of consolidation, voids, thickness, segregation and testing, as considered appropriate. Production paving may be started immediately after the results of 7-day tests of the cores (and the sawed beams) have been approved and after approval of the test section.

1.11 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.11.1 Bulk Cementitious Materials

All cementitious material shall be furnished in bulk. The temperature of the cementitious material, as delivered to storage at the site, shall not exceed 150 degrees F.

1.11.1.1 Transportation

When bulk cementitious material is not unloaded from primary carriers directly into weather-tight hoppers at the batching plant, transportation from the railhead, mill, or intermediate storage to the batching plant shall be accomplished in adequately designed weather-tight trucks, conveyors, or other means that will protect the cementitious material from exposure to moisture.

1.11.1.2 Storage Requirements

Immediately upon receipt at the site of the work, cementitious materials shall be stored in a dry and properly ventilated structure. All storage facilities shall be subject to approval and shall allow easy access for inspection and identification. Sufficient cementitious materials shall be in storage to sustain continuous operation of the concrete mixing plant while the pavement is being placed. To prevent cement from becoming unduly

aged after delivery, any cement that has been stored at the site for 60 days or more shall be used before using cement of lesser age.

1.11.1.3 Separation of Materials

Separate facilities shall be provided which will prevent any intermixing during unloading, transporting, storing, and handling of each type of cementitious material.

1.11.2 Aggregate Materials

1.11.2.1 Storage

Aggregate shall be stored at the site of the batching and mixing plant avoiding breakage, segregation, or contamination by foreign materials. Each size of aggregate from each source shall be stored separately in free-draining stockpiles. Fine aggregate and the smallest size coarse aggregate shall remain in free-draining storage for at least 24 hours immediately prior to use. Sufficient aggregate shall be maintained at the site at all times to permit continuous uninterrupted operation of the mixing plant at the time concrete pavement is being placed.

1.11.2.2 Handling

Aggregate shall be handled avoiding segregation or degradation. Vehicles used for stockpiling or moving aggregate shall be kept clean of foreign materials. Tracked equipment shall not be allowed on coarse aggregate stockpiles. Stockpiles shall be built up and worked avoiding segregation in the piles and preventing different sizes of aggregate from being mixed during storage or batching. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed and unused.

1.11.3 Other Materials

Reinforcing bars and accessories shall be stored above the ground on platforms, skids, or other supports. Other materials shall be stored avoiding contamination and deterioration. Chemical admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. The Contractor shall ensure that materials can be accurately identified after bundles or containers are opened.

1.12 EQUIPMENT

All plant, equipment, tools, and machines used in the work shall be maintained in satisfactory working conditions at all times.

1.12.1 Batching and Mixing Plant

1.12.1.1 Location of Batching and Mixing Plant

The batching and mixing plant shall be located off Government promises no more than 15 minutes haul time from the placing site. There shall be operable telephonic or radio communication between the batching plant and the placing site at all times concreting is taking place.

1.12.1.2 Type and Capacity of Batching and Mixing Plant

The batching and mixing plant shall be a stationary-type plant. The plant shall be designed and operated to produce concrete within the specified tolerances, and shall have a capacity of at least 250 cu. yd. per hour. The batching plant shall conform to the requirements of **NRMCA CPMB 100** and as specified; however, rating plates attached to batch plant equipment are not required.

1.12.1.3 Equipment Requirements

The batching controls shall be either semiautomatic or automatic. Semiautomatic batching system shall be provided with interlocks. Separate bins or compartments shall be provided for each size group of aggregate and each cementitious material. Aggregates shall be weighed either in separate weigh batchers with individual scales or cumulatively in one weigh batcher on one scale, provided the fine aggregate is weighed first. Aggregate shall not be weighed in the same batcher with cementitious material. If both cement and pozzolan are used, they may be batched cumulatively, provided portland cement is batched first. Water shall not be weighed or measured cumulatively with another ingredient. Water batcher filling and discharging valves shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. An accurate mechanical device for measuring and dispensing each chemical admixture shall be provided. Each dispenser shall be interlocked with the batching cycle and discharged automatically to obtain uniform distribution throughout the batch in the specified mixing period. Different chemical admixtures shall not be combined before introduction in water and cement. The plant shall be arranged to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment.

1.12.1.4 Scales

Adequate facilities shall be provided for the accurate measurement and control of each of the materials entering each batch of concrete. The weighing equipment shall conform to the applicable requirements of **NIST HB 44**, except that the accuracy shall be within 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Each weighing unit shall include a visible springless dial, which shall indicate the scale load at all stages of the weighing operation or shall include a beam scale with a beam balance indicator that will show the scale in balance at zero load and at any beam setting. The indicator shall have an over and under travel equal to at least 5 percent of the capacity of the beam. Approved electronic digital indicators and load cells may also be used. The weighing equipment shall be arranged to allow the concrete plant operator to conveniently observe the dials or indicators.

1.12.1.5 Batching Tolerances

The following tolerances shall apply.

Materials	Percentage of Required Mass
_____	_____

Cement (and Pozzolan)	plus or minus 1
Aggregate	plus or minus 2
Water	plus or minus 1
Admixture	plus or minus 3

For volumetric batching equipment for water and admixtures, the above numeric tolerances shall apply to the required volume of material being batched. Concentrated admixtures shall be uniformly diluted, if necessary, to provide sufficient volume per batch to ensure that the batchers will consistently operate within the above tolerance.

1.12.1.6 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture contents of the aggregates and to change the quantities of the materials being batched. An electric moisture meter complying with the provisions of **COE CRD-C 143** shall be provided for measuring of moisture in the fine aggregate. The sensing element shall be arranged so that measurement is made near the batcher charging gate of the fine aggregate bin or in the fine aggregate batcher.

1.12.1.7 Recorders

A graphic or digital recorder conforming to the requirements of **NRMCA CPMB 100** shall be furnished and kept operational at the batching plant.

1.12.2 Concrete Mixers

Mixers shall be stationary mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Mixer blades or paddles shall be replaced when worn down more than 10 percent of their depth when compared with the manufacturer's dimension for new blades or paddles.

1.12.2.1 Stationary, Central Plant, Mixers

Stationary mixers shall be drum mixers of tilting type. Mixers shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed.

1.12.2.2 Mixing Time and Uniformity

- a. Stationary Mixers: For stationary mixers, before uniformity data are available, the mixing time for each batch after all solid materials are in the mixer, provided that all of the mixing water is introduced before one-fourth of the mixing time has elapsed, shall be 1 minute for mixers having a capacity of 1 cubic yard. For mixers of greater capacity, this minimum time shall be increased 20 seconds for each additional 1.33 cubic yard or fraction thereof. After results of uniformity tests are available, the mixing time may be reduced to the minimum time required to meet uniformity requirements; but if uniformity requirements are not

being met, the mixing time shall be increased as directed. Mixer performance tests at new mixing times shall be performed immediately after any change in mixing time. When regular testing is performed, the concrete shall meet the limits of any five of the six uniformity requirements listed in Table 4, below. When abbreviated testing is performed, the concrete shall meet only those requirements listed for abbreviated testing. The concrete proportions used for uniformity tests shall be as used on the project. Regular testing shall consist of performing all six tests on three batches of concrete. The range for regular testing shall be the average of the ranges of the three batches. Abbreviated testing shall consist of performing the three required tests on a single batch of concrete. The range for abbreviated testing shall be the range for one batch. If more than one mixer is used and all are identical in terms of make, type, capacity, condition, speed of rotation, etc., the results of tests on one of the mixers shall apply to the others, subject to the approval of the Contracting Officer. All mixer performance (uniformity) testing shall be performed by the Contractor in accordance with COE CRD-C 55 and with paragraph titled TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL.

TABLE 4
UNIFORMITY REQUIREMENTS--STATIONARY MIXERS

Parameter	Regular Tests Allowable Maximum Range for Average of 3 Batches	Abbreviated Tests Allowable Maximum Range for 1 Batch
Unit weight of air-free mortar, lb/cubic ft	2.0	2.0
Air content, percent	1.0	--
Slump, inches	25	--
Coarse aggregate, percent	6.0	6.0
Compressive strength at 7 days, percent	10.0	10.0
Water content, percent	1.5	--

1.12.3 Transporting Equipment

Concrete shall be transported to the paving site in nonagitating equipment conforming to ASTM C 94/C 94M in approved truck mixers designed with extra large blading and rear opening specifically for low slump concrete or in approved agitators. All transporting equipment shall be designed and operated to deliver and discharge the required concrete mixture completely without segregation.

1.12.4 Transfer and Spreading Equipment

Equipment for transferring concrete from the transporting equipment to the paving lane in front of the paver shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will transfer and spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently. The travelling surge hopper shall be a specially manufactured, self-propelled transfer-placer which will operate in front of the paver and accept the concrete from the transporting equipment outside the paving lane, store it as necessary, and feed it out evenly across the lane in front of the paver at a depth which permits the paver to operate efficiently. The capacity shall be such that concrete is always available in front of the paver, to prevent the need for stopping the paver. It shall be designed to always discharge the oldest concrete remaining in the hopper before the fresher concrete.

1.12.5 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall weigh at least 4430 kg per m of lane width, and shall be powered by an engine having at least 6.0 horsepower per foot of lane width. Track widths shall be a minimum 350 mm wide. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The mechanisms for forming the pavement shall be easily adjustable in width and thickness and for required crown. In addition to other spreaders required by paragraph Transfer and Spreading Equipment, the paver-finisher shall be equipped with a full width knock-down auger or paddle mechanism, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete, as required. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 30 inches. Spud vibrators shall operate at a frequency of not less than 8000 impulses per minute and an amplitude of not less than 0.03 inch and tube vibrators at a frequency of not less than 5000 impulses per minute and an amplitude of not less than 0.03 inch, as determined by COE CRD-C 521. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface and shall so finish the surface that no significant amount of hand finishing, except use of cutting straightedges, is required. The screed or extrusion plate shall be constructed to provide adjustment for crown in the pavement. The entire machine shall provide adjustment for variation in lane width or thickness and to prevent more than 8 inches of the screed or extrusion plate extending over previously placed concrete on either end when paving fill-in lanes. Machines that cause displacement of properly installed forms or cause ruts or indentations in the prepared underlying materials and machines that cause frequent delays due to mechanical failures shall be replaced as directed.

1.12.5.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to keep it aligned with the forms and to spread the load so as to prevent deformation of the forms.

1.12.5.2 Slipform Paver-Finisher

The slipform paver-finisher shall be automatically controlled and crawler mounted with four padded tracks so as to be completely stable under all operating conditions. The paver-finisher shall finish the surface and edges so that no edge slump beyond allowable tolerance occurs. Horizontal alignment shall be electronically referenced to a taut wire guideline. Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or, only where permitted by paragraph Slipform Paving, to a ski operating on a completed lane. Suitable moving side forms shall be provided that are adjustable and will produce smooth, even edges, perpendicular to the top surface and meeting specification requirements for alignment and freedom from edge slump.

1.12.5.3 Longitudinal Mechanical Float

A longitudinal mechanical float shall be specially designed and manufactured to smooth and finish the pavement surface without working excess paste to the surface. It shall be rigidly attached to the rear of the paver-finisher or to a separate self-propelled frame spanning the paving lane. The float plate shall be at least 5 feet long by 8 inches wide and shall automatically be oscillated in the longitudinal direction while slowly moving from edge to edge of the paving lane, with the float plate in contact with the surface at all times.

1.12.5.4 Nonrotating Pipe Float

A pipe float if used, shall be a nonrotating pipe 6 to 10 inches in diameter and sufficiently long to span the full paving width when oriented at an angle of approximately 60 degrees with the centerline. The pipe float shall be mounted on a self-propelled frame that spans the paving lane. No means of applying water to the surface shall be incorporated in the pipe float.

1.12.5.5 Other Types of Finishing Equipment

Clary screeds, laser screeds, or other rotating tube floats, or bridge deck finishers, shall not be allowed on the project. Concrete finishing equipment of types other than specified above may be demonstrated on a test section outside the production pavement if approved in writing. If the Contracting Officer's representative decides from evaluation of the test section that the equipment is better than the specified finishing equipment, its use will be permitted as long as it continues to perform better than the specified equipment.

1.12.6 Curing Equipment

Equipment for applying membrane-forming curing compound shall be mounted on a self-propelled frame that spans the paving lane. The reservoir for curing compound shall be constantly mechanically (not air) agitated during operation and shall contain means for completely draining the reservoir. The spraying system shall consist of a mechanically powered pump which will maintain constant pressure during operation, an operable pressure gauge, and

either a series of spray nozzles evenly spaced across the lane to give uniformly overlapping coverage or a single spray nozzle which is mounted on a carriage which automatically traverses the lane width at a speed correlated with the forward movement of the overall frame. All spray nozzles shall be protected with wind screens. Any hand-operated sprayers allowed by paragraph Membrane Curing shall be compressed air supplied by a mechanical air compressor. If the curing machine fails to apply an even coating of compound at the specified rate, it shall immediately be replaced.

1.12.7 Texturing Equipment

Texturing equipment shall be as specified below. Before use, the texturing equipment shall be demonstrated on a test section, and the equipment shall be modified as necessary to produce the texture directed.

1.12.7.1 Fabric Drag

A fabric drag shall consist of a piece of material as long as the lane width securely attached to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. Width of the material shall provide 12 to 18 inches dragging flat on the pavement surface. Length shall be at least equal to the width of the slab plus 24 inches. The material shall be clean, reasonably new burlap, completely saturated with water before attachment to the frame and always resaturated before start of use and kept clean and saturated during use. Burlap shall conform to [AASHTO M 182](#), Class 3 or 4.

1.12.8 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-type concrete saws mounted on a wheeled chassis which can be easily guided to follow the required alignment. Blades shall be diamond tipped. If demonstrated to operate properly, abrasive blades may be used. Wheel saws shall be saws with large diameter tungsten carbide tipped blades mounted on a heavy-duty chassis which will produce a saw kerf at least 1-1/2 inch wide. All saws shall be capable of sawing to the full depth required.

1.12.9 Straightedge

The Contractor shall furnish and maintain at the job site, in good condition, one 12 foot straightedge for each paving train for testing the hardened portland cement concrete surfaces. These straightedges shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

1.12.10 Profilograph

The Contractor shall furnish a 25 foot profilograph for testing the finished pavement surface. The profilograph shall produce a record on tape of the results of testing the pavement surface and shall automatically mark the Profile Index of each section tested as well as indicate and measure each "must grind" point, all in accordance with [CDT Test 526](#) and as required by paragraph Surface Smoothness.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement, or portland-pozzolan cement, or only portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Temperature of cementitious materials as supplied to the project shall not exceed 150 degrees F.

2.1.1 Portland Cement

Portland cement shall conform to **ASTM C 150**, Type I or II, low-alkali.

2.1.2 Blended Cements

Blended cement shall conform to **ASTM C 595**, Type IP .

2.1.3 Pozzolan (Fly Ash and Silica Fume)

2.1.3.1 Fly Ash

Fly ash shall conform to **ASTM C 618**, Class F, including the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A in ASTM C618.

2.2 AGGREGATES

2.2.1 Aggregate Sources

Fine and coarse aggregates to be used in all concrete shall be evaluated and tested by the Contractor for alkali-aggregate reactivity in accordance with **ASTM C 1260**. Both coarse aggregate size groups shall be tested if from different sources. Test results shall have a measured expansion equal to or less than 0.08 percent at 16 days after casting. Should the test data indicate an expansion greater than 0.08 percent, the aggregate(s) shall be rejected, or additional testing, using a modified version of **ASTM C 1260**, shall be performed by the Contractor as described below. **ASTM C 1260** shall be modified as follows to include one of the following options:

- a. Utilize the Contractor's proposed low alkali portland cement and Class F fly ash in combination for the test proportioning. Class F fly ash shall contain less than 8 percent Calcium Oxide (CaO) and shall be used in the range of 25 to 40 percent of the total cementitious material by mass. The quantity shall be determined that will meet all the requirements of these specifications and which will lower the expansion equal to or less than 0.08 percent at 16 days after casting.
- b. Utilize the Contractor's proposed low alkali portland cement and ground granulated blast furnace (GGBF) slag in combination for the test proportioning. GGBF slag shall be used in the range of 40 to 50 percent of the total cementitious material by mass. The quantity shall be determined that will meet all the requirements of these specifications and which will lower the expansion equal to or less than 0.08 percent at 16 days after casting.

If any of the above options does not lower the expansion equal to or less than 0.08 percent at 16 days after casting, the aggregate(s) shall be rejected and the Contractor shall submit new aggregate sources for retesting. The results of the testing shall be submitted to the Contracting Officer for evaluation and acceptance.

2.2.2 Coarse Aggregate

Coarse aggregate shall have a satisfactory service record of at least 5 years successful service in three paving projects or, if a new source is used, shall meet the requirements when tested for resistance to freezing and thawing.

2.2.2.1 Material Composition

Coarse aggregate shall consist of crushed gravel or crushed stone. Crushed gravel shall contain not less than 75 percent of crushed particles by mass in each sieve size, as determined by COE CRD-C 171.

2.2.2.2 Quality

Aggregates as delivered to the mixers shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33 and other requirements specified herein. Coarse aggregate shall be washed. Washing shall be sufficient to remove dust and other coatings. .

2.2.2.3 Particle Shape Characteristics

Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by COE CRD-C 119. A flat particle is defined as one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

2.2.2.4 Size and Grading

The nominal maximum size of the coarse aggregate shall be 38 inches and shall meet the size groups below. When the nominal maximum coarse size is greater than 1 inch, the aggregates shall be furnished in two size groups as follows:

Nominal Maximum Size Inches	Size Group
3/4	ASTM C 33 --No. 67 (No. 4 to 3/4 inch)
1-1/2	ASTM C 33 --No. 4 (3/4 to 1-1/2 inch)

The grading of the coarse aggregate within the separated size groups shall conform to the requirements of ASTM C 33, Sizes 67 and 4 as delivered to the mixer.

2.2.2.5 Deleterious Materials - Airfield Pavements

Weather Severity	Air Freezing Index Coldest year in 30 (a)	Average Precipitation for any Single Month during the Freezing Period
Moderate	500 or less	Any Amount
Moderate (b)	501 or more	Less than 25 mm (1 inch)
Severe	501 or more	25 mm (1 inch) or more

The amount of deleterious material in each sieve size of coarse aggregate shall not exceed the limits shown in Table 5 below, determined in accordance with the test methods shown.

TABLE 5
LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE
FOR AIRFIELD PAVEMENTS
Percentage by Mass

Clay lumps and friable particles (ASTM C 142)	0.2
Shale (a) (ASTM C 295)	0.5
Material finer than 0.075 mm (No. 200 sieve) (b) (ASTM C 117)	1.0
Lightweight particles (c) (ASTM C 123)	0.5
Clay ironstone (d) (ASTM C 295)	1.0
Chert and cherty stone (less than 2.40 Mg/cubic meter density SSD (2.40 Sp. Gr.)) (e) (ASTM C 295)	1.0
Claystone, mudstone, and siltstone (f) (ASTM C 295)	1.0
Shaly and argillaceous limestone (g) (ASTM C 295)	1.0
Other soft particles COE CRD-C 130	1.0
Total of all deleterious substances exclusive of material finer than 0.075 mm (No. 200 sieve)	3.0

- a. Shale is defined as a fine-grained, thinly laminated or fissile sedimentary rock. It is commonly composed of clay or silt or both.

It has been indurated by compaction or by cementation, but not so much as to have become slate.

- b. Limit for material finer than 0.075 mm (No. 200 sieve) will be increased to 1.5 percent for crushed aggregates if the fine material consists of crusher dust that is essentially free from clay or shale.
- c. The separation medium shall have a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0). This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.
- d. Clay ironstone is defined as an impure variety of iron carbonate, iron oxide, hydrous iron oxide, or combinations thereof, commonly mixed with clay, silt, or sand. It commonly occurs as dull, earthy particles, homogeneous concretionary masses, or hard-shell particles with soft interiors. Other names commonly used for clay ironstone are "chocolate bars" and limonite concretions.
- e. Chert is defined as a rock composed of quartz, chalcedony or opal, or any mixture of these forms of silica. It is variable in color. The texture is so fine that the individual mineral grains are too small to be distinguished by the unaided eye. Its hardness is such that it scratches glass but is not scratched by a knife blade. It may contain impurities such as clay, carbonates, iron oxides, and other minerals. Other names commonly applied to varieties of chert are: flint, jasper, agate, onyx, hornstone, porcellanite, novaculite, sard, carnelian, plasma, bloodstone, touchstone, chrysoprase, heliotrope, and petrified wood. Cherty stone is defined as any type of rock (generally limestone) that contains chert as lenses and nodules, or irregular masses partially or completely replacing the original stone.
- f. Claystone, mudstone, or siltstone, is defined as a massive fine-grained sedimentary rock that consists predominantly of indurated clay or silt without laminations or fissility. It may be indurated either by compaction or by cementation.
- g. Shaly limestone is defined as limestone in which shale occurs as one or more thin beds or laminae. These laminae may be regular or very irregular and may be spaced from a few inches down to minute fractions of an inch. Argillaceous limestone is defined as a limestone in which clay minerals occur disseminated in the stone in the amount of 10 to 50 percent by weight of the rock; when these make up from 50 to 90 percent, the rock is known as calcareous (or dolomitic) shale (or claystone, mudstone, or siltstone).

2.2.2.6 Testing Sequence Deleterious Materials -- Airfields Only

The size of the sample shall be at least 200 pounds for the 3/4 to 1-1/2 inch size and 25 pounds for the No. 4 to 3/4 inch coarse aggregate and 10 pounds for the fine aggregate. The Contractor shall provide facilities for the ready procurement of representative test samples. Samples shall be taken and tested by and at the expense of the Contractor, using appropriate Corps of Engineers laboratory and ASTM test methods. Additional tests and analyses of aggregates at various stages in the processing and handling

operations may be made by the Government at the discretion of the Contracting Officer. Such Government testing will not relieve the Contractor of any of its testing responsibilities. The testing procedure on each sample of coarse aggregate for compliance with limits on deleterious materials shall be as follows:

Step 1: Test approximately one-fifth of sample for material finer than the No. 200 sieve.

Step 2: Wash off material finer than No. 200 sieve from the remainder of the sample and recombine the remainder with material retained on the No. 200 sieve from Step 1.

Step 3: Test remaining full sample for clay lumps and friable particles and remove.

Step 4: Test remaining full sample for lightweight particles and remove, and then for chert and/or cherty stone with SSD density of less than 2.40 Mg/cubic meter (Sp. Gr. 2.40) and remove.

Step 5: Test remaining sample for clay-ironstone, shale, claystone, mudstone, siltstone, shaly and/or argillaceous limestone, and remove.

Step 6: Test approximately one-fifth of remaining full sample for other soft particles.

Determination of deleterious materials listed in Steps 4 and 5 shall be performed by an individual specifically trained in petrographic identification. The individual selected to perform the identification of these deleterious materials shall be subject to approval and, at least 15 days before any individual is proposed to commence this type of work, the Contractor shall submit a written resume of the individual's training and experience for approval by the Corps of Engineers Omaha District, Attention David P. Ray, P.E., CENWO-ED-GA, Omaha, Nebraska, 68028. The Contractor will not be entitled to any extension of time or additional payment due to any delays caused by the testing, evaluation, or personnel requirements.

2.2.2.7 Resistance to Freezing and Thawing

Coarse aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with [COE CRD-C 114](#).

2.2.2.8 Resistance to Abrasion

Coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with [ASTM C 131](#).

2.2.3 Fine Aggregate

Fine aggregate shall have a service record of at least 5 years satisfactory service in three paving projects or, if a new source is used, shall meet the requirements for resistance to freezing and thawing.

2.2.3.1 Composition

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. Irrespective of the source from which it is obtained, all fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of [ASTM C 33](#). Each type of fine aggregate shall be stockpiled and batched separately. Any degree of contamination will be cause for the rejection of the entire stockpile.

2.2.3.2 Particle Shape

Particles of the fine aggregate shall be generally spherical or cubical in shape.

2.2.3.3 Grading

Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of [ASTM C 33](#). In addition, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.50 nor more than 3.00. The grading of the fine aggregate also shall be controlled so that the fineness moduli of at least nine of every set of ten consecutive samples of the fine aggregate, as delivered to the mixer, will not vary more than 0.15 from the average fineness moduli of all samples previously taken. The fineness modulus shall be determined by [COE CRD-C 104](#).

2.2.3.4 Deleterious Material

The amount of deleterious material in the fine aggregate shall not exceed the following limits by mass:

<u>Material</u>	<u>Percentage by Mass</u>
Clay lumps and friable particles ASTM C 142	1.0
Material finer than 0.075 mm (No. 200 sieve) ASTM C 117	3.0
Lightweight particles ASTM C 123 using a medium with a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0))	0.5
Total of all above	3.0

2.2.3.5 Resistance to Freezing and Thawing

Fine aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with [COE CRD-C 114](#).

2.3 CHEMICAL ADMIXTURES

2.3.1 Air-Entraining Admixtures

The air-entraining admixture shall conform to [ASTM C 260](#) and shall consistently entrain the air content in the specified ranges under field conditions. The air-entraining admixture shall be in a solution of suitable concentration for field use.

2.3.2 Accelerator

An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to **ASTM C 494/C 494M**, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

2.3.3 Retarder

A retarding admixture shall meet the requirements of **ASTM C 494/C 494M**, Type B, except that the 6-month and 1-year compressive strength tests are waived. The use of the admixture is at the option of the Contractor, but shall not be used to reduce the amount of cementitious material.

2.3.4 Water-Reducer

A water-reducing admixture shall meet the requirements of **ASTM C 494/C 494M**, Type A or D except that the 6-month and 1-year compressive strength tests are waived. The admixture may be added to the concrete mixture only when its use is approved or directed, and only when it has been used in mixture proportioning studies to arrive at approved mixture proportions.

2.4 CURING MATERIALS

2.4.1 Membrane Forming Curing Compound

Membrane forming curing compound shall be a white pigmented compound conforming to **COE CRD-C 300**.

2.4.2 Burlap

Burlap used for curing shall conform to **AASHTO M 182**, Class 3 or 4. Materials shall be new or shall be clean materials never used for anything other than curing concrete.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of **COE CRD-C 400**.

2.6 JOINT MATERIALS

2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to **ASTM D 1752** Type I or II . Expansion joint filler shall be as shown on the drawings.

2.6.2 Slip Joint Material

Slip joint material shall be 1/4 inch thick expansion joint filler conforming to **ASTM D 1752**.

2.7 REINFORCING

All reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties shall not be used.

2.7.1 Reinforcing Bars and Bar Mats

Reinforcing bars shall conform to ASTM A 615/A 615M, billet-steel ASTM A 616/A 616M, rail-steel ASTM A 617/A 617M, axle-steel, Grade and size as shown on the drawings. Bar mats shall conform to ASTM A 184/A 184M. The bar members shall be billet steel.

2.7.2 Welded Wire Fabric

Welded steel wire fabric shall conform to ASTM A 185.

2.7.3 Deformed Wire Fabric

Welded deformed steel wire fabric shall conform to ASTM A 497.

2.8 DOWELS

2.8.1 Dowels

Dowels shall be single piece bars fabricated or cut to length at the shop or mill before delivery to the site. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight. Dowels may be sheared to length provided that the deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and does not extend more than 0.04 inch from the end of the dowel. Dowels shall be plain (non-deformed) steel bars conforming to ASTM A 615/A 615M, Grade 40 or 60; ASTM A 616/A 616M, Grade 50 or 60; or ASTM A 617/A 617M, Grade 40 or 60; or shall be steel pipe conforming to ASTM A 53/A 53M, extra strong, as indicated. If split dowels are proposed for use, a complete description of the materials and installation procedures shall be submitted for approval at least 15 days before start of construction. At least on half of the smooth dowel shall be epoxy-coated and shall conform to ASTM A 775/A 775M.

2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C 881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

- a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.
- b. Material for use as patching materials for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.
- c. Material for use for injecting cracks shall be Type IV, Grade 1.

- d. Material for bonding freshly mixed portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

2.10.1 Specified Flexural Strength

Specified flexural strength, R, for concrete is psi at 90 days, as determined by tests made in accordance with [ASTM C 78](#) of beams fabricated and cured in accordance with [ASTM C 192/C 192M](#) or as determined by equivalent flexural strength for acceptance as specified in paragraph, Flexural Strength. Maximum allowable water-cementitious material ratio is 0.45 . The water-cementitious material ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag by the mass equivalency method described in [ACI 211.1](#). The concrete shall be air-entrained with a total air content of 5 plus or minus 1.0 percentage points, at the point of placement. Air content shall be determined in accordance with [ASTM C 231](#). The maximum allowable slump of the concrete at the point of placement shall be 2 inches for pavement constructed with fixed forms. For slipformed pavement, at the start of the project, the Contractor shall select a maximum allowable slump which will produce in-place pavement meeting the specified tolerances for control of edge slump. The selected slump shall be applicable to both pilot and fill-in lane construction.

2.10.2 Concrete Temperature

The temperature of the concrete as delivered shall conform to the requirements of paragraphs, Paving in Hot Weather and Paving in Cold Weather. Temperature of concrete shall be determined in accordance with [ASTM C 1064/C 1064M](#). The maximum allowable concrete temperature shall be 32 degrees Centigrade and the minimum allowable concrete temperature shall be 10 degrees Centigrade.

2.10.3 Concrete Strength for Final Acceptance

The strength of the concrete will be considered acceptable when the average 14-day flexural strengths for each lot are above the 'Specified Flexural Strength' and no individual set (2 beams per subplot) in the lot are 25 psi or more below the 'Specified Flexural Strength'. If any lot or subplot, respectively, fails to meet the above criteria, the lot or subplot shall be removed and replaced at no additional cost to the Government. This is in addition to and does not replace the average strength required for day-to-day CQC operations as specified in paragraph Average Flexural Strength Required for Mixtures.

2.11 MIXTURE PROPORTIONS BY CONTRACTOR

2.11.1 Composition

Concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. The cementitious material shall be portland cement, or blended cement; or only portland cement in combination with pozzolan. The total cementitious material content shall be at least 517 lb./cu. yd. Admixtures shall consist of air entraining admixture and may also include, as approved accelerator, retarders, and/or water-reducing

admixture. If water-reducer is used, it shall be used only at the dosage determined during mixture proportioning studies. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used.

2.11.2 Concrete Proportioning Studies, Pavement Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall be the responsibility of the Contractor. Mixture proportioning studies shall be performed by a commercial laboratory, inspected by the Government, and approved in writing. The laboratory performing the mixture proportioning shall conform with [ASTM C 1077](#). Strength requirements during mixture proportioning studies shall be based on flexural strength as determined by test specimens fabricated in accordance with [ASTM C 192/C 192M](#) and tested in accordance with [ASTM C 78](#). Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use on the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in [ACI 211.1](#), modified as necessary to accommodate flexural strength.

2.11.2.1 Water-Cement Ratio

At least three different water-cement ratios, which will produce a range of strength encompassing that required on the project, shall be used. The maximum allowable water-cement ratio required in paragraph Maximum Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the mass ratio of water to cement plus pozzolan by the weight equivalency method as described in [ACI 211.1](#). Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content.

2.11.2.2 Trial Mixture Studies

Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any placing method proposed which requires special properties. The temperature of concrete in each trial batch shall be reported. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding. Concrete proportioning studies shall be performed using the following procedures:

2.11.2.3 Mixture Proportioning for 28-day Flexural Strength

The following step by step procedure shall be followed:

- a. Fabricate all beams for each mixture from the same batch or blend of batches. Fabricate and cure all beams in accordance with [ASTM C 192/C 192M](#), using 6 x 6 inch beams 6 x 12 inch.
- b. Test beams in accordance with [ASTM C 78](#).

- c. Fabricate and cure test beams from each mixture for 7, 14, and 28-day flexural tests; 6 beams to be tested per age.
- d. Using the average strength for each w/c at each age, plot all results from each of the three mixtures on separate graphs for w/c versus:
 - 7-day flexural strength
 - 14-day flexural strength
 - 28-day flexural strength
- e. From these graphs select a w/c that will produce a mixture giving a 28-day flexural strength equal to the required strength determined in accordance with paragraph "Average Flexural Strength Required for Mixtures".
- f. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions.

2.11.3 Contractor Quality Control for Average Flexural Strength

The Contractor's day to day production shall be Controlled (CQC) in accordance with the criteria herein, in the following subparagraphs, and in par. 'Concrete Strength Testing for CQC'. This is entirely different from the acceptance requirements of paragraph: 'Concrete Strength for Final Acceptance', and it is mandatory that both sets of requirements must be met. If at any time, the 14-day flexural strength, for any lot is 69 psi or more below the 'required average 14-day flexural strength', as specified below, the paving operation shall be stopped and the Contractor shall take necessary steps to improve the mixture proportioning, materials, or the batching and mixing to increase the strength. The paving operations shall not recommence until the Contracting Officer has approved the Contractor's Proposed changes in writing.

2.11.3.1 Average CQC Flexural Strength Required for Mixtures

In order to ensure meeting, the strength requirements specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES, during production, the mixture proportions selected during mixture proportioning studies and used during construction shall produce a required average CQC flexural strength exceeding the specified strength, R, by the amount indicated below. This required average CQC flexural strength, Ra, will be used only for CQC operations as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and as specified in the previous paragraph. During production, the required Ra shall be adjusted (increased or decreased), as appropriate and as approved, based on the 14-day strengths being attained during paving.

- a. From Previous Test Records: Where a concrete production facility has previous test records, a standard deviation shall be established in accordance with the applicable provisions of **ACI 214.3R**. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected, shall represent concrete produced to meet a specified flexural strength or strengths within 150 psi of the 90-day flexural strength specified for the proposed work, and shall consist of at least 30 consecutive tests. A

strength test shall be the average of the strengths of two specimens made from the same sample of concrete and tested at 14 days. Required average CQC flexural strength, R_a , used as the basis for selection of concrete proportions shall be the value from the equation that follows, using the standard deviation as determined above:

$$R_a = R + 1.34S$$

Where: S = standard deviation
 R = specified flexural strength
 R_a = required average flexural strength

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

- b. Without Previous Test Records: When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength, R_a , shall be determined by adding 15 percent to the specified flexural strength, R .

PART 3 EXECUTION

3.1 PREPARATION FOR PAVING

Before commencing paving, the following shall be performed. Surfaces to receive concrete shall be prepared as specified below. If used, forms shall be in place, cleaned, coated, and adequately supported. Any reinforcing steel needed shall be at the paving site. All transporting and transfer equipment shall be ready for use, clean, and free of hardened concrete and foreign material. Equipment for spreading, consolidating, screeding, finishing, and texturing concrete shall be at the paving site, clean and in proper working order. All equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the paving site, in proper working condition, and in sufficient amount for the entire placement. When hot, windy conditions during paving appear probable, equipment and material shall be at the paving site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.2 CONDITIONING OF UNDERLYING MATERIAL

3.2.1 General Procedures

Underlying material subbase course, upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. Prior to setting forms or placement of concrete, the underlying material shall be well drained and shall have been satisfactorily graded and uniformly compacted in accordance with the applicable Section of these specifications. The surface of the subgrade or base course shall be tested as to crown, elevation, and density in advance of setting forms or of concrete placement using slip-form techniques. High areas shall be trimmed to proper elevation. Low areas shall be filled and compacted to a condition similar to that of surrounding grade, or filled with concrete monolithically with the pavement. Where low areas are filled with concrete, the areas shall be marked, as approved, and cores for thickness determinations as required by paragraph, Flexural Strength and Thickness shall not be drilled in those areas. Any underlying material disturbed by construction operations shall be reworked and recompact to specified density immediately in front of the paver. If a slipform paver is permitted and is used, the same underlying material under the paving lane shall be continued beyond the edge of the lane a sufficient distance and shall be thoroughly compacted and true to grade to provide a suitable trackline for the slipform paver and firm support for the edge of the paving lane. Where an open-graded granular base is required under the concrete, the Contractor shall select paving equipment and procedures which will operate properly on the base course without causing displacement or other damage.

3.2.2 Traffic on Underlying Material

After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon. Subject to specific approval, crossing of the prepared subgrade or base course at specified intervals for construction purposes may be permitted, provided rutting or indentations do not occur; however, if traffic has been allowed to use the prepared subgrade or base course, the surface shall be reworked and reprepared to the satisfaction of the Contracting Officer before concrete is placed.

3.3 WEATHER LIMITATIONS

3.3.1 Placement and Protection During Inclement Weather

The Contractor shall not commence placing operations when heavy rain or other damaging weather conditions appear imminent. At all times when placing concrete, the Contractor shall maintain on-site sufficient waterproof cover and means to rapidly place it over all unhardened concrete or concrete that might be damaged by rain. Placement of concrete shall be suspended whenever rain or other damaging weather commences to damage the surface or texture of the placed unhardened concrete, washes cement out of the concrete, or changes the water content of the surface concrete. All unhardened concrete shall be immediately covered and protected from the rain or other damaging weather. Any pavement damaged by rain or other weather shall be completely removed and replaced at the Contractor's expense as specified in paragraph, Repair, Removal, Replacement of Slabs.

3.3.2 Paving in Hot Weather

When the ambient temperature during paving is expected to exceed 90 degrees F, the concrete shall be properly placed and finished in accordance with procedures previously submitted and as specified herein. The concrete

temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with [ASTM C 1064/C 1064M](#). Cooling of the mixing water or aggregates or placing in the cooler part of the day may be required to obtain an adequate placing temperature. An approved retarder may be used to facilitate placing and finishing. Steel forms and reinforcing shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Transporting and placing equipment shall be cooled or protected if necessary to maintain proper concrete-placing temperature. Concrete shall be placed continuously and rapidly at a rate of not less than 100 feet of paving lane per hour. The finished surfaces of the newly laid pavement shall be kept damp by applying a fog spray (mist) with approved spraying equipment until the pavement is covered by the curing medium. If necessary, wind screens shall be provided to protect the concrete from an evaporation rate in excess of 0.2 lb./square foot per hour, as determined by method shown in Figure 2.1.5 of [ACI 305R](#).

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature in Degrees F
Greater than 60	90
40-60	85
Less than 40	80

3.3.3 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, the Contractor shall develop and institute measures to prevent plastic shrinkage cracks from developing. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of [ACI 305R](#). In addition to the protective measures specified in the previous paragraph, the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding, or wet covering. When such water treatment is stopped, curing procedures shall be immediately commenced. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.3.4 Paving in Cold Weather

Special protection measures, as submitted and approved, and as specified herein, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 40 degrees F. However, placement may begin when both the ambient temperature and the temperature of the underlying material are at least 35 degrees F and rising. When the ambient temperature is less than 50 degrees F, the temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature.

Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, chemical admixture conforming to ASTM C 494/C 494M Type C or E may be used provided it contains no calcium chloride. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS.

3.4 CONCRETE PRODUCTION

Batching, mixing, and transporting equipment shall have a capacity sufficient to maintain a continuous, uniform forward movement of the paver of not less than 2.5 feet per minute. Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 90 degrees F, the time shall be reduced to 30 minutes. No water shall be added to the concrete after it is batched except that, if truck mixers are permitted, water may be added at the paving site to adjust the slump as approved, provided the maximum allowable w/c is not exceeded. Such water shall be injected under pressure as described in subparagraph, Truck Mixers. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall be on approved forms and shall show at least the mass, or volume, of all ingredients in each batch delivered, and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government weekly.

3.4.1 Batching and Mixing Concrete

The batching and mixing equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and in operable condition at all times. Scale pivots and bearings shall be kept clean and free of rust. Any equipment which fails to perform as specified shall immediately be removed from use until properly repaired and adjusted, or replaced.

3.4.2 Transporting and Transfer - Spreading Operations

The transporting and transfer equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and in operable condition at all times. Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes at all times during the work day. Concrete shall be deposited as close as possible to its final position in the paving lane. All equipment shall be operated to discharge and transfer concrete without segregation. In no case shall dumping of concrete in discrete piles be permitted. No transfer or spreading operation which requires the use of front-end loaders, dozers, or similar equipment to distribute the concrete will be permitted. All batching and mixing, transporting, transferring, paving, and finishing shall be properly coordinated and controlled such that the paver-finisher has a continuous forward movement at a reasonably uniform speed from beginning to end of each paving lane, except for inadvertent equipment breakdown. Failure to achieve this shall require the Contractor

to halt operations, regroup, and modify operations to achieve this requirement.

3.5 PAVING

3.5.1 General Requirements

The paving and finishing equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and properly operable at all times. Pavement shall be constructed with paving and finishing equipment utilizing rigid fixed forms or by use of slipform paving equipment. Paving and finishing equipment and procedures shall be capable of constructing paving lanes of the required width at a rate of at least 100 feet of paving lane per hour on a routine basis. Paving equipment and its operation shall be controlled, and coordinated with all other operations, such that the paver-finisher has a continuous forward movement, at a reasonably uniform speed, from beginning to end of each paving lane, except for inadvertent equipment breakdown. Workmen with foreign material on their footwear or construction equipment that might deposit foreign material shall not be permitted to walk or operate in the plastic concrete.

3.5.2 Consolidation

Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. Gang-mounted vibrator spuds shall be spaced so as to thoroughly consolidate the entire paving lane, but not more than 30 inch spacing, and with the outside vibrators not more than 12 inches from the edge of the lane. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 2 inches. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. If the vibrators cause visible tracking in the paving lane, the paving operation shall be stopped and equipment and operations modified to prevent it. Concrete in small, odd-shaped slabs or in isolated locations inaccessible to the gang-mounted vibration equipment shall be vibrated with an approved hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete. Hand-operated vibrators shall not be operated in the concrete at one location for more than 20 seconds. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) shall require the immediate stopping of the paving operation and approved adjustment of the equipment or procedures.

3.5.3 Operation

When the paver approaches a header at the end of a paving lane, a sufficient amount of concrete shall be maintained ahead of the paver to provide a roll of concrete which will spill over the header. The amount of extra concrete shall be sufficient to prevent any slurry that is formed and carried along ahead of the paver from being deposited adjacent to the header. The spud vibrators in front of the paver shall be brought as close to the header as

possible before they are lifted. Additional consolidation shall be provided adjacent to the headers by hand-manipulated vibrators. When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 8 inches. These screeds or extrusion plates shall be electronically controlled from the previously placed pavement so as to prevent them from applying pressure to the existing pavement and to prevent abrasion of the pavement surface. The overlapping area of existing pavement surface shall at all times be kept completely free of any loose or bonded foreign material as the paver-finisher operates across it. When the paver travels on existing pavement, approved provisions shall be made to prevent damage to the existing pavement. Pavers using transversely oscillating screeds shall not be used to form fill-in lanes that have widths less than a full width for which the paver was designed or adjusted.

3.5.4 Required Results

The paver-finisher, and its gang-mounted vibrators, together with its operating procedures shall be adjusted and operated and coordinated with the concrete mixture being used to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The screed or the extrusion plate shall be properly adjusted to produce a pavement surface true to line and grade. Any necessary adjustment to compensate for surging behind the screed or for inadequate height of surface after paving shall be carefully made and checked frequently. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface; never more than 3/32 inch cover over the top layer of coarse aggregate. The paver-finisher shall make only one pass across the pavement; multiple passes will not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing other than the use of cutting straightedges, except in very infrequent instances. If any equipment or operation fails to produce the above results, the paving shall be stopped, the equipment shall be replaced or properly adjusted, the operation shall be appropriately modified, or the mixture proportions modified, in order to produce the required results before recommencing paving. No water, other than true fog sprays (mist) as specified in paragraph, Prevention of Plastic Shrinkage Cracking, shall be applied to the concrete or the concrete surface during paving and finishing.

3.5.5 Fixed Form Paving

Paving equipment for fixed-form paving and the operation thereof shall conform to the requirements of paragraph EQUIPMENT, all requirements specified above under paragraph PAVING and as specified herein.

3.5.5.1 Forms for Fixed-Form Paving

- a. Forms shall be steel, except that wood forms may be used for curves having a radius of 150 feet or less, and for fillets. Forms shall be equal in depth to the edge thickness of the slab as shown on the drawings. Forms shall be in one piece for the full depth required, except as permitted below. Under no conditions shall forms be adjusted by filling or excavating under the forms to an elevation other than the bottom of the pavement slab. Where the project

requires several different slab thicknesses, forms may be built up with metal or wood to provide an increase in depth of not more than 25 percent. The required form depth may be obtained by securely bolting or welding to the bottom of the form a tubular metal section of the proper thickness or by securely bolting wood planks to the bottom of the form. The tubular metal section or wood planks shall completely cover the underside of the base of the form and shall extend beyond the edge of the base a sufficient distance to provide the necessary stability. The base width of the one-piece form, or built-up form, shall be not less than eight-tenths of the vertical height of the form, except that forms 8 inches or less in vertical height shall have a base width not less than the vertical height of the form. Forms shall not be built-up by adding to the top. The top surface of each form section shall not vary more than 1/16 inch in 12 feet from a true line. The face of the form shall not vary more than 3/16 inch in 12 feet from a true plane. Forms with battered top surfaces or distorted faces or bases shall be removed from the project. Where keyway forms are required, they shall be rigidly attached to the main form so no displacement can take place. Metal keyway forms shall be tack-welded to steel forms. Keyway forms shall be so aligned that there is no variation over 1/4 inch either vertically or horizontally, when tested with a 12 foot template after forms are set, including tests across form joints.

- b. Steel forms shall be furnished in sections not less than 10 feet in length, except that on curves having a radius of 150 feet or less, the length of the sections shall be 5 feet unless the sections are flexible or curved to the proper radius. Each 10 foot length of form shall be provided with at least three form braces and pin sockets so spaced that the form will be rigidly braced throughout its length. Lock joints between form sections shall be free from play or movement. Forms shall be free of warps, bends, or kinks.
- c. Wood forms for curves and fillets shall be made of well-seasoned, surfaced plank or plywood, straight, and free from warp or bend. Wood forms shall be adequate in strength and rigidly braced.
- d. The forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire length and base width. Underlying material shall be thoroughly compacted and trimmed to grade before forms are set in place. Setting forms on blocks or on built-up spots of underlying material will be not permitted under any condition. The form sections shall be staked into position and tightly locked together. The length of pins and quantity provided in each section shall be sufficient to hold the form at the correct line and grade. When tested with a straightedge, the top of the installed form shall conform to the requirements specified for the finished surface of the concrete, and the longitudinal axis of the upstanding leg shall not vary more than 1/4 inch from the straightedge. Conformity to the alignment and grade elevations shown on the drawings shall be checked and necessary corrections shall be made immediately prior to placing the concrete. Forms shall be set well in advance of concrete placement. The forms shall be cleaned and oiled each time before concrete is placed. No

concrete shall be placed until setting of forms has been checked and approved by the CQC team.

3.5.5.2 Form Removal

Forms shall remain in place at least 12 hours after the concrete has been placed. When conditions are such that the early strength gain of the concrete is delayed, the forms shall be left in place for a longer time, as directed. Forms shall be removed by procedures that do not injure the concrete. Bars or heavy metal tools shall not be used directly against the concrete in removing the forms. Any concrete found to be defective after form removal shall be repaired promptly, using procedures specified hereinafter or as directed.

3.5.6 Slipform Paving

3.5.6.1 General

Paving equipment for slipform paving and the operation thereof shall conform to the requirement of paragraph EQUIPMENT, all requirements specified above in subparagraphs, General, Consolidation, Operation, and Required Results, and as specified herein. The slipform paver shall shape the concrete to the specified and indicated cross section, meeting all tolerances, in one pass. The slipform paver shall finish the surface and edges so that only a very minimum isolated amount of hand finishing is required. If the paving operation does not meet the above requirements and the specified tolerances, the operation shall be immediately stopped, and the Contractor shall regroup and replace or modify any equipment as necessary, modify paving procedures or modify the concrete mix, in order to resolve the problem. The slipform paver shall be automatically electronically controlled from a taut wire guideline for horizontal alignment and on both sides from a taut wire guideline for vertical alignment, except that electronic control from a ski operating on a previously constructed adjoining lane shall be used where applicable for either or both sides. Automatic, electronic controls for vertical alignment shall always be used on both sides of the lane. Control from a slope-adjustment control or control operating from the underlying material shall never be used. If approved by the Contracting Officer after a preconstruction demonstration, automatic laser controls may be used in lieu of or to supplement the taut wire guidelines. Side forms on slipform pavers shall be properly adjusted so that the finished edge of the paving lane meets all specified tolerances. Dowels in longitudinal construction joints shall be installed as specified below. The installation of these dowels by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete shall not be permitted.

3.5.6.2 Guideline for Slipform Paving

Guidelines shall be accurately and securely installed well in advance of concrete placement. Supports shall be provided at necessary intervals to eliminate all sag in the guideline when properly tightened. The guideline shall be high strength wire set with sufficient tension to remove all sag between supports. Supports shall be securely staked to the underlying material or other provisions made to ensure that the supports will not be displaced when the guideline is tightened or when the guideline or supports are accidentally touched by workmen or equipment during construction. The appliances for attaching the guideline to the supports shall be capable of easy adjustment in both the horizontal and vertical directions. When it is

necessary to leave gaps in the guideline to permit equipment to use or cross underlying material, provisions shall be made for quickly and accurately replacing the guideline without any delay to the forward progress of the paver. Supports on either side of the gap shall be secured in such a manner as to avoid disturbing the remainder of the guideline when the portion across the gap is positioned and tightened. The guideline across the gap and adjacent to the gap for a distance of 200 feet shall be checked for horizontal and vertical alignment after the guideline across the gap is tightened. Vertical and horizontal positioning of the guideline shall be such that the finished pavement shall conform to the alignment and grade elevations shown on the drawings within the specified tolerances for grade and smoothness. The specified tolerances are intended to cover only the normal deviations in the finished pavement that may occur under good supervision and do not apply to setting of the guideline. The guideline shall be set true to line and grade.

3.5.6.3 Laser Controls

If the Contractor proposes to use any type of automatic laser controls, a detailed description of the system shall be submitted and a trial field demonstration shall be performed in the presence of the Contracting Officer at least one week prior to start of paving. Approval of the control system will be based on the results of the demonstration and on continuing satisfactory operation during paving.

3.5.7 Placing Reinforcing Steel

The type and amount of steel reinforcement shall be as shown on the drawings. For pavement thickness of 12 inches or more, the reinforcement steel shall be installed by the strike-off method wherein a layer of concrete is deposited on the underlying material, consolidated, and struck to the indicated elevation of the steel reinforcement. The reinforcement shall be laid upon the prestruck surface, and the remaining concrete shall then be placed and finished in the required manner. When placement of the second lift causes the steel to be displaced horizontally from its original position, provisions shall be made for increasing the thickness of the first lift and depressing the reinforcement into the unhardened concrete to the required elevation. The increase in thickness shall be only as necessary to permit correct horizontal alignment to be maintained. Any portions of the bottom layer of concrete that have been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with newly mixed concrete without additional cost to the Government. For pavements less than 12 inches thick, the reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement. Concrete shall be vibrated after the steel has been placed. Regardless of placement procedure, the reinforcing steel shall be free from coatings which could impair bond between the steel and concrete, and laps in the reinforcement shall be as indicated. In lieu of the above, automatic reinforcement depressing attachments may be used to position the reinforcement, either bar mats or welded wire fabric, provided the entire operation is approved by the Contracting Officer. Regardless of the equipment or procedures used for installing reinforcement, the Contractor shall ensure that the entire depth of concrete is adequately consolidated.

3.5.8 Placing Dowels

The method used in installing and holding dowels in position shall ensure that the error in alignment of any dowel from its required alignment after the pavement has been completed will not be greater than 1/8 in. per ft. Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 5/8 inch. The Contractor shall furnish an approved template for checking the alignment and position of the dowels. The portion of each dowel intended to move within the concrete or expansion cap shall be epoxy coated. The epoxied portion shall be wiped clean and coated with a thin, even film of lubricating oil before the concrete is placed. Epoxy coated dowel bars shall be as specified in Part II. Pipe used as dowels shall be filled with a stiff sand-asphalt mixture or portland-cement mortar. Dowels in joints shall be omitted when the center of the dowel is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness. Dowels shall be installed as specified in the following subparagraphs.

3.5.8.1 Contraction Joints

Dowels in longitudinal and transverse contraction joints within the paving lane shall be held securely in place, as indicated, by means of rigid metal frames or basket assemblies of an approved type. The assemblies shall consist of a framework of metal bars or wires arranged to provide rigid support for the dowels throughout the paving operation, with a minimum of four continuous bars or wires extending along the joint line. The dowels shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from rising, sliding out, or becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors. At the Contractor's option, in lieu of the above, dowels in contraction joints shall be installed near the front of the paver by insertion into the plastic concrete using approved equipment and procedures. Approval will be based on the results of a preconstruction demonstration which the Contractor shall conduct, showing that the dowels are installed within specified tolerances.

3.5.8.2 Construction Joints-Fixed Form Paving

Installation of dowels shall be by the bonded-in-place method. Installation by removing and replacing in preformed holes will not be permitted. Dowels shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms. If split dowels are approved and used, the female portion of the split dowel shall be bonded in the initially placed pavement lane. The female portion of the split dowel shall be securely fastened to the pavement form and shall maintain the proper position and alignment of the dowel during concrete placement so that no mortar or other foreign material will enter the socket or coupling. Before the split dowels are assembled, the external and internal threads shall be cleaned thoroughly to remove all cement, cement mortar, grit, dirt, and other foreign matter. In the final assembly, a minimum torque of 200 ft-lbs shall be applied. The spacing of dowels in construction joints shall be as indicated, except that, where the planned spacing cannot be maintained because of form length or interference with form braces, closer spacing with additional dowels shall be used.

3.5.8.3 Dowels Installed in Hardened Concrete

Dowels installed in hardened concrete, such as in longitudinal construction joints for slipform paving, in joints between new and existing pavement, and similar locations, shall be installed by bonding the dowels into holes drilled into the hardened concrete. The installation of dowels in longitudinal construction joints by dowel inserters attached to a slipform paver or by any other means of inserting the dowels into the plastic concrete shall not be permitted. However, when paving two lanes together with a longitudinal contraction joint between, any dowels required may be installed in this joint with an approved inserter. Holes approximately 1/8 inch greater in diameter than the dowels shall be drilled into the hardened concrete with rotary core drills to receive the dowels. In lieu of rotary drills, the contractor may use percussion drills, provided that spalling at the collar of the hole does not occur. Regardless of the type of drill used, the drill shall be held rigidly in exact alignment by means of a stable jig or framework, solidly supported; gang drills meeting this are acceptable. Any damage to the concrete face during drilling shall be repaired as directed; continuing damage shall require modification of the equipment and operation. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing a straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel. The horizontal alignment shall be checked with a framing square. Dowels required to be installed in any joints between new and existing concrete shall be grouted in holes drilled in the existing concrete, all as specified above.

3.5.8.4 Expansion Joints

Dowels in expansion joints shall be installed as shown using appropriate procedures specified above.

3.6 FINISHING

The finishing machine, or paver-finisher, shall meet all requirements specified in paragraph EQUIPMENT and herein. Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver and the machines shall be designed and operated to strike off, screed, and consolidate the concrete. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Finishing shall be by the machine method. The hand method shall be used only infrequently and only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. When approved, the hand finishing method may also be used for separate, isolated slabs during removal and replacement type repair operations. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 10 to 12 feet cutting straightedges; only very sparing use of bull floats shall be allowed. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of

straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Every effort shall be made to prevent bringing excess paste to the surface and any operations which produce more than 3/32 inch of paste (mortar, water, laitance, etc.) over the top layer of coarse aggregate shall be halted immediately and the equipment, mixture, or procedures modified as necessary. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Surface checks shall be made regularly and paving operations immediately halted and adjustments made whenever compensation is inadequate. Screed and float adjustments of the machines shall be checked at the start of each day's paving operations and more often if required. Machines that cause frequent delays due to mechanical failure shall be replaced. When machines ride the edge of a previously constructed slab, the edge shall be kept clean and provision shall be made to protect the surface of the slab. Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment will not be permitted. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way, except for fog (mist) sprays specified to prevent plastic shrinkage cracking.

3.6.1 Longitudinal Floating

When the equipment contains a mechanical, longitudinal, oscillating float, the float shall be operated to smooth and finish the pavement immediately behind the transverse screed or extrusion plate. The float shall be operated maintaining contact with the surface at all times. Care shall be taken to prevent working paste to the surface in excess of the amount specified above.

3.6.2 Other Types of Finishing Equipment

Concrete finishing equipment of types other than those specified above may be used on a trial basis, when specifically approved, except that rotating pipe or tubes or bridge deck finishers will not be permitted. Approval will be given after demonstration on a test section prior to start of construction, and provided the Contracting Officer determines that the pavement produced is better than that produced by the specified equipment. The use of equipment that fails to produce finished concrete of the required quality, using concrete proportions and slump as specified, shall be discontinued, and the concrete shall be finished with specified equipment and in the manner specified above. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved. Slipform paving equipment shall not be operated on fixed forms unless approved in writing prior to use.

3.6.3 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be

immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

3.6.4 Machine Finishing With Slipform Pavers

The slipform paver shall be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements shall immediately be replaced or modified as necessary. A self-propelled nonrotating pipe float may be used if the Contractor desires while the concrete is still plastic, to remove minor irregularities and score marks. The pipe float shall be 6 to 10 inches in diameter and sufficiently long to span the full paving width when oriented at an angle of approximately 60 degrees with the center line. Only one pass of the pipe float shall be allowed. If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens. Slabs having areas of edge slump in excess of the specified tolerances shall be removed and replaced in accordance with paragraph, REPAIR, REMOVAL, REPLACEMENT OF SLABS; repair operations on such areas will not be permitted.

3.6.5 Surface Correction and Testing

After all other finishing is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of cutting straightedges. Such straightedges shall be 12 feet in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall be equipped with a handle 3 feet longer than one-half the width of the pavement. The surface shall then be tested for trueness with a straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-half the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is free from observable departure from the straightedge and conforms to the surface requirements specified in paragraph ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS. Long-handled, flat bull floats shall be used very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, the paving operation shall be stopped and the equipment, mixture or procedures adjusted to eliminate the surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Extreme care shall be taken to prevent overfinishing joints and edges. The surface finish of the pavement shall be produced essentially by the finishing machine and not by subsequent hand finishing operations. All hand finishing operations shall be subject to approval and shall be modified when directed. No water shall be added to the pavement surface during these operations.

3.6.6 Hand Finishing

Hand finishing operations shall be used only as specified above.

3.6.6.1 Equipment

In addition to approved mechanical internal vibrators for consolidating the concrete, a strike-off and tamping template and a longitudinal float shall be provided for hand finishing. The template shall be at least 1 foot longer than the width of pavement being finished, of an approved design, and sufficiently rigid to retain its shape, and shall be constructed of metal or other suitable material shod with metal. The longitudinal float shall be at least 10 feet long, of approved design, and rigid and substantially braced, and shall maintain a plane surface on the bottom. Grate tampers (jitterbugs) shall not be used.

3.6.6.2 Finishing and Floating

As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. In addition to previously specified complete coverage with handheld immersion vibrators, the entire surface shall be tamped with the strike-off and tamping template, and the tamping operation continued until the required compaction and reduction of internal and surface voids are accomplished (grate tampers shall not be used). Immediately following the final tamping of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. Long-handled, flat bull floats shall be used very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, the operation shall be stopped and adjusted to eliminate the surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Extreme care shall be taken to prevent overfinishing joints and edges. No water shall be added to the pavement during finishing operations.

3.6.7 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris.

3.6.7.1 Burlap Drag Surface Finish

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with an approved fabric drag. The drag shall be operated with the fabric moist, and the fabric shall be cleaned or changed as required to keep clean. The dragging shall be done so as to produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.6.8 Edging

After texturing has been completed, the edge of the slabs along the forms, along the edges of slipformed lanes, and at the joints shall be carefully finished with an edging tool to form a smooth rounded surface of 1/8 inch radius. Tool marks shall be eliminated, and the edges shall be smooth and true to line. No water shall be added to the surface during edging. Extreme care shall be taken to prevent overworking the concrete.

3.7 CURING

3.7.1 Protection of Concrete

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Sufficient sheet material to protect unhardened concrete from rain shall be at the paver at all times. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, the damaged pavement shall be removed and replaced, and another method of curing shall be employed as directed. Curing shall be accomplished by membrane curing.

3.7.2 Membrane Curing

A uniform coating of white-pigmented, membrane-forming, curing compound shall be applied to the entire exposed surface of the concrete as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs and bleeding is complete. Curing compound shall then be immediately applied. Along the formed edge faces, it shall be applied immediately after the forms are removed. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water, and the curing compound applied as soon as the free water disappears. The curing compound shall be applied to the finished surfaces by means of an approved automatic spraying machine. The spraying machine shall be self-propelled and shall span the newly paved lane. The machine shall have one or more spraying nozzles that can be controlled and operated to completely and uniformly cover the pavement surface with the required amount of curing compound. The curing compound in the drum used for the spraying operation shall be thoroughly and continuously agitated mechanically throughout the full depth of the drum during the application. Air agitation may be used only to supplement mechanical agitation. Spraying pressure shall be sufficient to produce a fine spray as necessary to cover the surface thoroughly and completely with a uniform film. Spray equipment shall be kept clean and properly maintained and the spray nozzle or nozzles shall have adequate wind shields. The curing compound shall be applied with an overlapping coverage that will give a two-coat application at a coverage of 400 square feet per gallon, plus or minus 5.0 percent for each coat. A one-coat application may be applied provided a uniform application and coverage of 200 square feet per gallon, plus or minus 5.0 percent is obtained. The application of curing compound by hand-operated, mechanical

powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. When the application is made by hand-operated sprayers, the second coat shall be applied in a direction approximately at right angles to the direction of the first coat. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. If pinholes, abrasions, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be immediately resprayed. The surfaces adjacent to joint sawcuts shall be cleaned and resprayed with curing compound immediately after cutting. Approved standby facilities for curing concrete pavement shall be provided at an accessible location at the job site for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.8 JOINTS

3.8.1 General Requirements for Joints

Joints shall conform to the details indicated and shall be perpendicular to the finished grade of the pavement. All joints shall be straight and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch. Before commencing construction, the Contractor shall submit for approval a control plan and equipment to be used for ensuring that all joints are straight from edge to edge of the pavement within the above tolerances. Where any joint fails to meet these tolerances, the slabs adjacent to the joint shall be removed and replaced at no additional cost to the Government. No change from the jointing pattern shown on the drawings shall be made without written approval of the Contracting Officer. Sealing of joints shall be in accordance with Section 02760A FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

3.8.2 Longitudinal Construction Joints

Longitudinal construction joints between paving lanes shall be located as indicated. Dowels shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated. Dowels shall be installed in conformance with paragraph, Placing Dowels and Tie Bars. After the end of the curing period, longitudinal construction joints shall be sawed to provide a groove at the top for sealant conforming to the details and dimensions indicated.

3.8.3 Transverse Construction Joints

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for 30 minutes or longer. When concrete

placement cannot be continued, the transverse construction joint shall be installed at a planned transverse joint, if possible. Transverse construction joints shall be constructed by utilizing headers and the very minimum amount of hand placement and finishing techniques. Pavement shall be constructed with the paver as close to the header as possible, and the paver shall be run out completely past the header. Transverse construction joints installed at a planned transverse joint shall be constructed as shown or, if not shown otherwise, shall be dowelled. Those not at a planned transverse joint shall be constructed with tie bars and shall not be sawed or sealed.

3.8.4 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using joint filler of the type, thickness, and width indicated, and shall be installed to form a complete, uniform separation between the structure and the pavement. The filler shall be attached to the original concrete placement with adhesive or other fasteners and shall extend the full slab depth. Adjacent sections of filler shall be fitted tightly together, and the filler shall extend across the full width of the paving lane or other complete distance in order to prevent entrance of concrete into the expansion space. Edges of the concrete at the joint face shall be finished with an edger with a radius of 1/8 inch. The joint filler strips shall be installed 3/4 inch below the pavement surface with a slightly tapered, dressed-and-oiled wood strip or other approved material temporarily secured to the top of the filler to form a recess to be filled with joint sealant. The wood strip shall be removed soon after the concrete has set and the reservoir temporarily filled with an approved material to protect the reservoir until the joint sealer is installed. Expansion joints shall be constructed with thickened edges for load transfer.

3.8.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type and shall be constructed as indicated. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw in conformance with requirements for sawed joints, unless otherwise approved in writing. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints

3.8.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing an initial groove in the concrete with a 1/8 inch blade to the indicated depth. During sawing of joints, and again 24 hours later, the CQC team shall inspect all exposed lane edges for development of cracks below the saw cut, and shall immediately report results to the Contracting Officer. If the Contracting Officer determines that there are more uncracked joints than desired, the Contractor will be directed to saw succeeding joints 25 percent deeper than originally indicated at no additional cost to the Government. After expiration of the curing period, the upper portion of the groove shall be widened by sawing to the width and depth indicated for the joint sealer. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping,

spalling, or tearing. The sawed faces of joints will be inspected for undercutting or washing of the concrete due to the early sawing, and sawing shall be delayed if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. The sawing operation shall be carried on as required during both day and night regardless of weather conditions. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. A chalk line or other suitable guide shall be used to mark the alinement of the joint. Before sawing a joint, the concrete shall be examined closely for cracks, and the joint shall not be sawed if a crack has occurred near the planned joint location. Sawing shall be discontinued when a crack develops ahead of the saw cut. Workmen and inspectors shall wear clean, rubber-soled footwear, and the number of persons walking on the pavement shall be limited to those actually performing the sawing operation. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, but that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord, backer rod, or other approved material before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period and shall prevent infiltration of foreign material until removed immediately before sawing joint sealant reservoir. The sawing equipment shall be adequate in the number of units and the power to complete the sawing at the required rate. An ample supply of saw blades shall be available on the job before concrete placement is started and at all times during sawing. At least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operation.

3.8.6 Thickened Edge Joints

Thickened edge joints shall be constructed as indicated on the drawings. Underlying material in the transition area shall be graded as shown and shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.8.7 Sealing Joints

Joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Joints shall be sealed as specified in Section 02760A FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS .

3.9 REPAIR, REMOVAL, REPLACEMENT OF SLABS

3.9.1 General Criteria

New pavement slabs that are broken or contain cracks shall be removed and replaced or repaired, as specified hereinafter at no cost to the Government. Spalls along joints shall be repaired as specified. Where removal of partial slabs is permitted, as specified, removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be normal to the paving lane and not less than 10 feet from each original transverse joint (i.e., removal portion shall be at least 10 feet

longitudinally, and portion to remain in place shall be at least <MET>10 feet</MET> longitudinally; thus, if original slab length is less than 20 feet, the entire slab shall be removed). The Contracting Officer will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be at least 6 inch diameter, shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Government. All epoxy resin used in this work shall conform to paragraph EPOXY RESIN, Type and Grade as specified.

3.9.2 Slabs with Cracks Thru Interior Areas

Interior area is defined as that area more than 24 inches from either adjacent original transverse joint. Slabs with any cracks that extend into the interior area, regardless of direction, shall be treated by one of the following procedures.

3.9.2.1 Cracks That Do Not Extend Full Depth of Slab

These cracks, and similar cracks within the areas 24 inches each side of transverse joints, shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1, using procedures as approved. The procedure shall not widen the crack during epoxy resin injection. All epoxy resin injection shall take place in the presence of a representative of the Contracting Officer.

3.9.2.2 Cracks That Extend Full Depth of Slab

Where there is any full depth crack at any place within the interior area, the full slab shall be removed. However, if the cracked area all lies within 10 feet of one original transverse joint, only a partial slab need be removed provided all criteria specified above for distance from each original transverse joint is met.

3.9.3 Cracks close to and Parallel to Transverse Joints

All cracks essentially parallel to original transverse joints, extending full depth of the slab, and lying wholly within 24 inches either side of the joint shall be treated as specified hereinafter. Any crack extending more than 24 inches from the transverse joint shall be treated as specified above for Slabs With Cracks Through Interior Areas. Any cracks which do not extend full depth of the slab shall be treated as specified above in subparagraph, Cracks That Do Not Extend Full Depth Of Slab, and the original transverse joint constructed as originally designed.

3.9.3.1 Full Depth Cracks Present, Original Joint Not Opened

When the original transverse joint has not opened, the crack shall be routed and sealed, and the original transverse joint filled with epoxy resin. The crack shall be routed with an easily guided, wheel mounted, vertical shaft, powered rotary router designed so the routing spindle will caster as it moves along the crack, or with a small diameter saw designed for this use. The reservoir for joint sealant in the crack shall be formed by routing to a depth of 3/4 inch, plus or minus 1/16 inch, and to a width of 5/8 inch, plus or minus 1/8 inch. Any equipment or procedure which causes ravelling or

spalling along the crack shall be modified or replaced to prevent such raveling or spalling. The joint sealant shall be a liquid sealant as specified for rigid pavement joints. Installation of joint seal shall be as specified for sealing joints or as directed. The uncracked transverse joint shall be filled with epoxy resin. If the joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures. If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. If filler material (joint insert) has been used to form a weakened plane in the transverse joint, it shall be completely sawed out and the saw cut pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. Where a parallel crack goes part way across the paving lane and then intersects and follows the original transverse joint which is cracked only for the remainder of the width, it shall be treated as follows: The area with the separate crack shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

3.9.3.2 Full Depth Cracks, Original Joint Also Cracked

At a transverse joint, if there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, a section of the slab containing the crack shall be removed and replaced for the full lane width and at least 10 feet long. If this partial slab removal places the limit of removal less than 10 feet from the next transverse joint, the entire slab shall be removed. If the parallel crack crosses the transverse joint line, a similar area shall be removed and replaced in both slabs.

3.9.4 Removal and Replacement of Full Slabs

Where it is necessary to remove full slabs, unless there are keys or dowels present, all edges of the slab shall be cut full depth with a concrete saw. All saw cuts shall be perpendicular to the slab surface. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 6 inches from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 1 inch of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and approved safe lifting devices used for attachment to the slabs. The narrow strips along keyed or doweled edges shall be carefully broken up and removed using light, hand-held jackhammers, 30 lb or less, or other approved similar equipment. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset in any direction greater than 1/2 inch and no gradual offset greater than 1 inch when tested in a horizontal direction with a straightedge. No mechanical impact breakers, other than the above hand-held equipment shall be used for any removal of slabs. If underbreak between 1-1/2 and 4 inches deep occurs at any point along any edge, the area shall be repaired as directed before replacing the removed slab. Procedures directed will be similar to those specified for surface spalls, modified as necessary. If underbreak over 4 inches deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where

they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified in paragraph, Placing Dowels and Tie Bars. Original damaged dowels or tie bars shall be cut off flush with the joint face. Protruding portions of dowels shall be painted and lightly oiled. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material shall be recompact and shaped as specified in the appropriate section of these specifications, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care shall be taken to prevent any curing compound from contacting dowels or tie bars. The resulting joints around the new slab shall be prepared and sealed as specified for original construction.

3.9.5 Removal and Replacement of Partial Slabs

Where the above criteria permits removal of partial slabs, removal and replacement operations shall be as specified for full slabs, except that the joint between the removed area and the partial slab to remain in place shall consist of a full depth saw cut across the full lane width and perpendicular to the centerline of the paving lane. Replacement operations shall be the same as specified above, except that, at the joint between the removed area and the partial slab to remain, deformed tie bars shall be epoxy resin grouted into holes drilled into the slab to remain in place. Size and spacing of the tie bars shall be as specified for dowels. Drilling of holes and installation of tie bars shall be as specified for dowels in paragraph, Placing Dowels and Tie Bars, except that no portion of the tie bars shall be painted or oiled. No curing compound shall be used on this joint face and, immediately before placing new concrete, the joint surface of the partial slab remaining in place shall be coated with epoxy resin, Type V, Grade 2.

3.9.6 Repairing Spalls Along Joints

Where directed, spalls along joints of new slabs, along edges of adjacent existing concrete, and along parallel cracks shall be repaired by first making a vertical saw cut at least 1 inch outside the spalled area and to a depth of at least 2 inches. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete and at least a depth of 1/2 inch of visually sound concrete. The cavity thus formed shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout. The cavity shall be filled with low slump portland cement concrete. 1/3 cu. ft. 0.03 cu. ft. 1/3 cu. ft.; 0.03 cu. ft. Portland cement concretes and mortars shall be very low slump mixtures, 1/2 inch slump or less, proportioned, mixed, placed, consolidated by tamping, and cured, all as directed. Mechanical vibrators and hand tampers shall be used to consolidate the concrete or mortar. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium

shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and then sealed with the sealer specified for the joints. If any spall penetrates half the depth of the slab or more, the entire slab, or 10 foot portion thereof, shall be removed and replaced as previously specified. In lieu of sawing, spalls not adjacent to joints, and popouts, both less than 6 inches in maximum dimension, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.

3.10 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Existing concrete pavement shall be removed as indicated and as specified in Section 02222 AIRFIELD PAVEMENT REMOVAL, modified, and expanded as specified herein. Repairs shall be made as indicated and as specified herein. All operations shall be carefully controlled to prevent damage to the concrete pavement and to the underlying material to remain in place. All saw cuts shall be made perpendicular to the slab surface, and forming rectangular areas.

3.10.1 Removal of Existing Pavement Slab

When existing concrete pavement is to be removed and adjacent concrete is to be left in place, the joint between the removal area and adjoining pavement to stay in place shall first be cut full depth with a standard diamond-type concrete saw. Next, a full depth saw cut shall be made parallel to the joint at least 24 inches from the joint and at least 6 inches from the end of any dowels. This saw cut shall be made with a wheel saw as specified in paragraph SAWING EQUIPMENT. All pavement to be removed beyond this last saw cut shall be removed using equipment and procedures specified in Section 02222 AIRFIELD PAVEMENT REMOVAL and as approved. All pavement between this last saw cut and the joint line shall be removed by carefully pulling pieces and blocks away from the joint face with suitable equipment and then picking them up for removal. In lieu of this method, this strip of concrete may be carefully broken up and removed using hand-held jackhammers, 30 lb or less, or other approved light-duty equipment which will not cause stress to propagate across the joint saw cut and cause distress in the pavement which is to remain in place. In lieu of the above specified removal method, the slab may be sawcut full depth to divide it into several pieces and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and safe lifting devices used for attachment to the slab. Dowels of the size and spacing indicated shall be installed as shown on the drawings by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph, Placing Dowels.

3.10.2 Edge Repair

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Areas which are damaged during construction shall be repaired at no cost to the Government; repair of previously existing damage areas will be considered a subsidiary part of concrete pavement construction.

3.10.2.1 Spall Repair

Spalls along joints and along cracks shall be repaired where indicated and where directed. Repair materials and procedures shall be as previously specified in subparagraph, Repairing Spalls Along Joints.

3.10.2.2 Underbreak Repair

All underbreak shall be repaired. First, all delaminated and loose material shall be carefully removed. Next, the underlying material shall be recompacted, without addition of any new material. Finally, the void shall be completely hand-filled with paving concrete mixture, thoroughly consolidated. Care shall be taken to produce an even joint face from top to bottom. Prior to placing concrete, the underlying material shall be thoroughly moistened. After placement, the exposed surface shall be heavily coated with curing compound. All this shall be done at least 24 hours before placing the new paving concrete against the joint.

3.10.2.3 Underlying Material

The underlying material adjacent to the edge of and under the existing pavement which is to remain in place shall be protected from damage or disturbance during removal operations and until placement of new concrete, and shall be shaped as shown on the drawings or as directed. Sufficient underlying material shall be kept in place outside the joint line to completely prevent disturbance of material under the pavement which is to remain in place. Any material under the portion of the concrete pavement to remain in place which is disturbed or loses its compaction shall be carefully removed and replaced with concrete as specified above under Underbreak Repair. The underlying material outside the joint line shall be thoroughly compacted and shall be moist when new concrete is placed.

3.11 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Government. Aggregates rubble, or other similar construction materials shall not be piled on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least 14 days old, or for a longer period if so directed. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. Also, the subgrade planer, concrete paving and finishing machines, and similar equipment may be permitted to ride upon the edges of previously constructed slabs when the concrete has attained a minimum flexural strength of 400 psi and approved means are furnished to prevent damage to the slab edge. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean, and spillage of concrete or other materials shall be cleaned up immediately upon occurrence. Special care shall be used where Contractor's traffic uses or crosses active airfield pavement. In these areas, if necessary in order to accomplish this, full-time workmen with hand brooms shall be used at anytime there is traffic. Other existing pavements used by the Contractor shall be power broomed at least daily when traffic operates. For fill-in lanes, equipment shall be used that will not damage or spall the edges or joints of the previously constructed pavement.

3.12 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

3.12.1 Testing and Inspection by Contractor

The Contractor shall perform the inspection and tests described below, and based upon the results of these inspections and tests, shall take the action required and submit reports as required. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease. The laboratory performing the tests shall be on-site and shall conform with [ASTM C 1077](#). The individuals who sample and test concrete or the constituents of concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall have demonstrated a knowledge and ability equivalent to the ACI minimum guidelines for certification of Concrete Construction Inspector, Level II. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with [ASTM C 1077](#). This testing shall be performed by the Contractor regardless of any other testing performed by the Government, either for pay adjustment purposes or for any other reason.

3.12.2 Testing and Inspection Requirements

3.12.2.1 Fine Aggregate

- a. Grading. At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with [ASTM C 136](#) and [COE CRD-C 104](#) for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits.
- b. Corrective Action for Fine Aggregate Grading. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall be immediately reported to the Contracting Officer, paving shall be stopped, and immediate steps taken to correct the grading.

3.12.2.2 Coarse Aggregate

- a. Grading. At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with [ASTM C 136](#) for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt approved limits for control coarser than the specification limits for

samples taken other than as delivered to the mixer to allow for degradation during handling.

- b. Corrective Action for Grading. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer, and steps taken to correct the grading. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer, paving shall be stopped, and immediate steps shall be taken to correct the grading.

3.12.2.3 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests specified for aggregate quality, including deleterious materials. In addition, after the start of paving, the Contractor shall perform similar tests for aggregate quality at least once every month, and when the source of aggregate or aggregate quality changes. Testing interval may be increased to three months when the previous two tests indicate the aggregate meets all quality requirements. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.12.2.4 Scales, Batching and Recording

- a. Weighing Accuracy. The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every month for conformance with specified requirements. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors.
- b. Batching and Recording Accuracy. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required mass, recorded mass, and the actual mass batched. The Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately.
- c. Corrective Action. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.12.2.5 Batch-Plant Control

The measurement of all constituent materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate masses and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required

aggregate and water masses per cubic yard, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic yard for each class of concrete batched during each day's plant operation.

3.12.2.6 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with **ASTM C 231**. Test results shall be plotted on control charts which are kept current and shall, at all times, be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an average line is set at the midpoint of the specified air content range from paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content shall be taken at the paving site. The Contractor shall deliver the concrete to the paving site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the paving site, correlation samples shall be taken at the paving site as required by the Contracting Officer, and the air content at the mixer controlled as directed.
- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to insure that it is operating accurately and with good reproducibility. Whenever a point on either control chart (single test or result of two tests made concurrently, as specified above) reaches an action limit line, the air content shall be considered out of control and the paving operation shall immediately be halted until the air content

is under control. Additional air content tests shall be made when paving is restarted.

- c. Slump Testing. Slump tests shall be made when test specimens are fabricated. In addition, at least four other slump tests shall be made on randomly selected batches in accordance with **ASTM C 143/C 143M** for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond the upper action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control chart for slump and the chart for range, and for determining need for any remedial action. An upper warning limit shall be set at 1/2 inch below the maximum allowable slump on separate control charts for slump used for each type of mixture as specified in paragraph, SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES, and an upper action limit line shall be set at the maximum allowable slump, as specified in the same paragraph for fixed form paving or as selected by the Contractor at the start of the project for slipform paving. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 1-1/2 inches. Samples for slump shall be taken at the paving site. The Contractor is responsible for delivering the concrete to the paving site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the paving site, correlation samples shall be taken at the paving site as required by the Contracting Officer, and the slump at the mixer controlled as directed.
- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an approved adjustment shall immediately be made in the batch masses of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c specified, based on aggregates which are in a saturated surface dry condition. When a slump result (average of two tests made concurrently, as specified above) exceeds the upper action limit, no further concrete shall be delivered to the paving site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch masses, produce a point on the control chart for range at or above the upper action limit, the paving operation shall immediately be halted, and the Contractor shall take approved steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement

shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.

3.12.2.7 Concrete Strength Testing for CQC

Contractor Quality Control operations for concrete strength shall consist of the following steps:

- a. Take samples for strength tests at the paving site. Fabricate and cure test cylinders in accordance with ASTM C 31/C 31M; test them in accordance with ASTM C 39/C 39M.
- b. Fabricate and cure 2 test beams per subplot from the same batch or truckload and at the same time acceptance beams are fabricated and test them for flexural strength at 7-day age.
- c. Average all 8 compressive tests per lot. Convert this average 7-day compressive strength per lot to equivalent 90-day flexural strength using the Correlation Ratio determined during mixture proportioning studies.
- d. Compare the equivalent 90-day flexural strength from the conversion to the Average Flexural Strength Required for Mixtures from paragraph of same title.
- e. If the equivalent average 90-day strength for the lot is below the Average Flexural Strength Required for Mixtures by 20 psi flexural strength or more, at any time, adjust the mixture to increase the strength, as approved.
- f. If the equivalent average 90-day strength is above the Average Flexural Strength Required for Mixtures by 20 psi flexural strength or more for 2 consecutive days, the Contractor will be permitted to adjust the mixture to decrease the strength, as approved.
- g. The Contractor's CQC testing agency shall maintain up-to-date control charts for strength, showing the 7-day CQC compressive strength, the 14-day compressive strength (from acceptance tests) and the 90-day equivalent flexural strength of each of these for each lot.

3.12.2.8 Inspection Before Placing

Underlying materials, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by the Contractor in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.12.2.9 Paving

- a. Paving Inspection. The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown and that finishing is performed as specified; shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement,

volume of concrete placed, and method of paving and any problems encountered.

- b. Placing and Paving Corrective Action. The paving foreman shall not permit batching and paving to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Paving shall not be continued if piles of concrete exist or if the concrete is inadequately consolidated or if surface finish is not satisfactory. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.12.2.10 Vibrators

- a. Vibrator Testing and Use. The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when paving is in progress. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing.
- b. Vibrator Corrective Action. Any vibrator not meeting the requirements of subparagraphs, Paver-Finisher and Consolidation, shall be immediately removed from service and repaired or replaced.

3.12.2.11 Curing Inspection

- a. Moist Curing Inspections. At least twice each shift, and not less than four times per day (never more than 7 hours apart) on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each day's operation, the quantity of compound used shall be determined by measurement of the container and the area of concrete surface covered; the Contractor shall then compute the rate of coverage in square feet per gallon and shall also note whether or not coverage is uniform. All this shall be reported daily.

- d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.
- f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.12.2.12 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.12.2.13 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 4 months when concrete is being placed, or once for every 50,000 cubic yards of concrete placed, whichever results in the longest time interval, uniformity of concrete mixing shall be determined in accordance with [COE CRD-C 55](#). The original test shall be a Regular Test. After the mixing operation has been tested and approved, subsequent tests shall be Abbreviated Tests.
- b. Truck Mixers. Prior to the start of concrete placing and at least once every 4 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with [ASTM C 94/C 94M](#). The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.
- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved. After adjustments have been made, another uniformity test shall be made.

3.12.2.14 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be

confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

SECTION 02821A

FENCING
02/02
AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 121	(1999) Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 153/A 153M	(2001) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 392	(1996) Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 491	(1996) Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 585	(1997) Aluminum-Coated Steel Barbed Wire
ASTM A 780	(2000) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 824	(1995) Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM F 1043	(2000) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(1997) Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F 1184	(1994) Industrial and Commercial Horizontal Slide Gates
ASTM F 626	(1996a) Fence Fittings
ASTM F 883	(1997) Padlocks
ASTM F 900	(1994) Industrial and Commercial Swing Gates

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Chain Link Fence;

Statement, signed by an official authorized to certify on behalf of the manufacturer, attesting that the chain link fence and component materials meet the specified requirements.

SD-10 Operation and Maintenance Data

Gate Operator;

Six copies of operating and maintenance instructions, a minimum of 2 weeks prior to field training. Operating instructions shall outline the step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance instructions shall include routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include the general gate layout, equipment layout and simplified wiring and control diagrams of the system as installed.

PART 2 PRODUCTS

2.1 FENCE FABRIC

Fence fabric shall conform to the following:

2.1.1 Chain Link Fence Fabric

ASTM A 392, Class 1, zinc-coated steel wire with minimum coating weight of 370 grams of zinc per square meter of coated surface, or ASTM A 491, Type I, aluminum-coated steel wire. Fabric shall be fabricated of 9 gauge wire woven in 50 mm mesh. Fabric height shall be [AM#2] 2.13 m. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

2.2 GATES

ASTM F 900 and/or ASTM F 1184. Gate shall be the type and swing shown. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate fabric shall be as specified for chain link fabric. Gate leaves more than 2.44 m wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 2.44 m wide shall have truss rods or

intermediate braces. Intermediate braces shall be provided on all gate frames with an electro-mechanical lock. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position. For high security applications, each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

2.3 POSTS

2.3.1 Metal Posts for Chain Link Fence

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II, roll-formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

2.4 BRACES AND RAILS

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group II, formed steel sections, size 42 mm, conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished.

2.5 WIRE

2.5.1 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

2.6 ACCESSORIES

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Barbed wire shall be 2 strand, 12-1/2 gauge wire, zinc-coated, Class 3 in accordance with ASTM A 121 or aluminum coated Type I in accordance with ASTM A 585. Barbed wire shall be four-point barbed type steel wire. Barbed wire support arms shall be the single arm type and of the design required for the post furnished. Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the fence fabric. Miscellaneous hardware coatings shall conform to ASTM A 153/A 153M unless modified.

2.7 CONCRETE

ASTM C 94/C 94M, using 19 mm maximum size aggregate, and having minimum

compressive strength of 21 MPa at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.8 PADLOCKS

Padlocks shall conform to ASTM F 883, Type PO1, Grade 2, Size 44 mm (1-3/4 inch) . All padlocks shall be keyed alike and each lock shall be furnished with two keys.

2.9 GATE OPERATOR

Electric gate operators for sliding gates shall be as follows: Electrical gate operators shall have a right angle gearhead instantly reversing motor with magnetic drum-type brake, friction disc clutch, reversing starter with thermal overload protection, and a chain-driven geared rotary-type automatic limit switch. Gears shall consist of a hardened steel machine cut worm and mating bronze gear. All gears and bearings shall operate in a bath of oil. Gate operators with V-belt pulleys will not be allowed. Gate operators shall be equipped with an emergency release to allow the gate to be operated manually. The emergency release mechanism shall be capable of being locked in the engaged or disengaged position. Positive stops shall be provided on the gate tracks as a backup to the limit switches.

PART 3 EXECUTION

3.1 INSTALLATION

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 3 m. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 152.4 m. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A 780.

3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain a 25 mm clearance between the bottom of the fabric and finish grade.

3.3 POST INSTALLATION

3.3.1 Posts for Chain Link Fence

Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 457 mm in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to the minimum depth indicated on the drawing unless a penetration of 457 mm in solid rock is achieved before reaching the indicated depth, in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than the diameter shown on the drawings. Diameters of holes in solid

rock shall be at least 25 mm greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Driven posts shall be set to a minimum depth of 914 mm and shall be protected with drive caps when being set. For high security fences, fence post rigidity shall be tested by applying a 222.4 newtons force on the post, perpendicular to the fabric, at 1.52 m above ground; post movement measured at the point where the force is applied shall be less than or equal to 19 mm from the relaxed position; every tenth post shall be tested for rigidity; when a post fails this test, further tests on the next four posts on either side of the failed post shall be made; all failed posts shall be removed, replaced, and retested at the Contractor's expense.

3.4 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 1.83 m in height. A center brace or 2 diagonal truss rods shall be installed on 3.66 m fences. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 1.83 m high or less if a top rail is installed.

3.5 TENSION WIRES

Tension wires shall be installed along the top and bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top tension wires shall be installed within the top 102 mm of the installed fabric. Bottom tension wire shall be installed within the bottom 152 mm of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.6 CHAIN LINK FABRIC

Chain link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 381 mm intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 381 mm intervals and fastened to all rails and tension wires at approximately 610 mm intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 50 mm plus or minus 13 mm above the ground.

3.7 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE

3.7.1 General Requirements

Barbed wire supporting arms and barbed wire shall be installed as indicated and as recommended by the manufacturer. Supporting arms shall be anchored to the posts in a manner to prevent easy removal with hand tools. Barbed wire shall be pulled taut and attached to the arms with clips or other means that will prevent easy removal.

3.8 GATE INSTALLATION

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Slide gates shall be installed as recommended by the manufacturer. Padlocks shall be attached to gates or gate posts with chains. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal.

3.9 GROUNDING

Where indicated, fences shall be grounded on each side of all gates, at each corner, at the closest approach to each building located within 15 m of the fence, and where the fence alignment changes more than 15 degrees. Grounding locations shall not exceed 198 m. Each gate panel shall be bonded with a flexible bond strap to its gate post. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 19 mm by 3.05 m long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 300 mm below the grade. Where driving is impracticable, electrodes shall be buried a minimum of 305 mm deep and radially from the fence. The top of the electrode shall be not less than 610 mm or more than 2.4 m from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

-- End of Section --

SECTION 02919

TOPSOILING

08/2002

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES (NOT APPLICABLE)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Equipment List;

The Contractor shall furnish a list and description of the equipment that is proposed for handling and placing all topsoil.

Sources; G.

The Contractor shall notify the Contracting Officer for approval, in writing, the source(s) of the topsoil.

SD-07 Certificates

Topsoil; G.

The Contractor shall furnish a certificate of compliance and analysis certifying that the topsoil proposed for use at the project site conforms to the specified requirements.

1.3 INSPECTION

Not less than 5 days prior to the commencement of topsoiling operations, the Contracting Officer shall be notified of the offsite sources from which topsoil is to be furnished. The material will be inspected to determine whether the selected topsoil meets the requirements. The topsoil shall be approved prior to use.

PART 2 PRODUCTS

2.1 TOPSOIL

All topsoil necessary to complete the work shall be obtained from topsoil stockpiles from grading and excavating operations, from approved topsoil sources off of Government controlled property and topsoil borrow area indicated on the drawings. Topsoil from approved sources and stockpiled topsoil shall be natural, friable, topsoil characteristic of representative

soils in the vicinity that produce heavy growths of crops, grass, or other vegetation. Topsoil shall be free from tree roots, stones, shale, parent and other materials that hinder grading, planting, plant growth and maintenance operations, and free from noxious and other objectionable weed seeds and toxic substances.

PART 3 EXECUTION

3.1 GENERAL

Graded areas shall be topsoiled where it is determined by the Contracting Officer that at least 100 mm of suitable soil for the growth of grass is not present. Equipment necessary for handling and placing all materials required shall be on hand, in good condition and shall be approved before the work is started. Grades on the areas to be topsoiled are shown on the drawings and shall be maintained in a true and even condition.

3.2 TILLAGE

Immediately prior to dumping and spreading the topsoil, the subgrade shall be double tilled to a depth of 50 mm using a chisel plow with the 1 chisels set not more than 250 mm apart. Tillage shall be accomplished across the slope.

3.3 OBTAINING TOPSOIL

After inspection and approval of the source of topsoil and Construction Equipment List, and prior to stripping, rank growths of vegetation, stones, or debris on the surface that might interfere with grading or later tillage operations shall be removed. Sod or other cover that cannot be disked or otherwise incorporated into the topsoil so that the topsoil can be spread properly shall be removed. Topsoil shall be removed to the depth specified by the Contracting Officer. Borrow areas shall be neatly trimmed and drained after borrow excavations are completed.

3.4 PLACING TOPSOIL

Topsoil shall be uniformly distributed and evenly spread to an average thickness of 100 mm , with a minimum thickness of 76 mm . Topsoil shall be spread so that planting can proceed with little additional soil preparation or tillage. Surface irregularities resulting from topsoiling or other operations shall be leveled to prevent depressions. The grades shall be adjusted to assure that the planted grade shall be 25 mm below the adjoining grade of any surfaced area. Topsoil shall not be placed when the subgrade is frozen, excessively wet or compacted, extremely dry, or in a condition detrimental to the proposed planting or grading.

3.5 CLEANUP

Prior to topsoiling, vegetation that may interfere with operations shall be mowed, grubbed, and raked. The collected material shall be removed from the site. The surface shall be cleaned of stumps, and stones larger than 25 mm in diameter, and roots, cable, wire and other materials that might hinder the work or subsequent maintenance shall also be removed.

3.6 REPAIR

Where any portion of the surfaces becomes gullied or otherwise damaged, the affected area shall be repaired to establish the condition and grade prior

to topsoiling, and then shall be re-topsoiled as specified in paragraph
"PLACING TOPSOIL."

-- End of Section --

SECTION 02964A

COLD MILLING OF BITUMINOUS PAVEMENTS

03/98

AMENEMENT #0002

PART 1 GENERAL

1.1 EQUIPMENT, TOOLS, AND MACHINES

Equipment, tools, and machines used in the performance of the work shall be maintained in a satisfactory working condition.

1.1.1 Cold-Milling Machine

The cold-milling machine shall be a self-propelled machine capable of milling the pavement to a specified depth and smoothness. Pavement milling machine shall be capable of establishing grade control; shall have means of controlling transverse slope; and shall have effective means of controlling dust produced during the pavement milling operation. The machine shall have the ability to remove the millings or cuttings from the pavement and load them into a truck. The milling machine shall not cause damage to any part of the pavement structure that is not to be removed.

1.1.2 Cleaning Equipment

Cleaning equipment shall be suitable for removing and cleaning loose material from the pavement surface.

1.1.3 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.66 meter straightedge or other suitable device for each milling machine, for testing the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal, and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on the pavement.

1.2 WEATHER LIMITATIONS

Milling shall not be performed when there is accumulation of snow or ice on the pavement surface.

1.3 GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

1.3.1 Grade

The finished milled surfaces shall conform to the lines, grades, and cross sections indicated. The finished milled-pavement surfaces shall vary not more than 12 mm from the established plan grade line and elevation. Finished surfaces at a juncture with other pavements shall coincide with the finished surfaces of the abutting pavements. The deviations from the plan grade line and elevation will not be permitted in areas of pavements where closer conformance with planned grade and elevation is required for

the proper functioning of appurtenant structures involved.

1.3.2 Surface Smoothness

Finished surfaces shall not deviate from the testing edge of a straightedge more than 6 mm in the transverse or longitudinal direction.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 MILLING OPERATION

Sufficient passes shall be made so that the designated area is milled to the grades and cross sections indicated. The milling shall proceed with care and in depth increments that will not damage the pavement below the designated finished grade. Cold-milling operation shall be conducted to ensure that only bituminous pavement is removed and base course is not disturbed. A layer of bituminous pavement, 6 to 13 mm, shall be left in place over the undisturbed base course. Items damaged during milling, such as manholes, valve boxes, utility lines, pavement that is torn, cracked, gouged, broken, or undercut, shall be repaired or replaced as directed.

3.2 GRADE AND SURFACE-SMOOTHNESS TESTING

3.2.1 Grade-Conformance Tests

The finished milled surface of the pavement shall be tested for conformance with the plan-grade requirements and will be tested for acceptance by the Contracting Officer by running lines of levels at intervals of 8 meters longitudinally and 8 meters transversely to determine the elevation of the completed pavement. The Contractor shall correct variations from the designated grade line and elevation in excess of the plan-grade requirements as directed. Skin patching for correcting low areas will not be permitted. The Contractor shall remove and replace the deficient low area. Sufficient material shall be removed to allow at least 25 mm of asphalt concrete to be placed.

3.2.2 Surface-Smoothness Tests

After completion of the final milling, the finished milled surface will be tested by the Government with a straightedge. Other approved devices may be used, provided that when satisfactorily and properly operated, such devices reveal all surface irregularities exceeding the tolerances specified. Surface irregularities that depart from the testing edge by more than 6 mm shall be corrected.

3.3 REMOVAL OF MILLED MATERIAL

Material that is removed shall be stockpiled as specified and in such a manner to prevent segregation or contamination.

-- End of Section --

SPECIAL SPECIFICATION

Item 3004

Micro-Surfacing (Polymer Modified)

AMENDMENT #0002

1. Description. This Item shall consist of a micro-surfacing system which shall be a mixture of cationic polymer modified asphalt emulsion, mineral aggregate, mineral filler, water and other additives mixed and placed on the paved surface in accordance with these specifications and to the dimensions as shown on the plans.

2. Materials.

- (1) Asphaltic Material.

The asphalt material, designated as CSS-1P, shall be a cationic slow setting emulsion modified with an approved polymer. The polymer shall be incorporated by blending with the base asphalt prior to emulsification or it shall be co-milled with the asphalt to produce the finished emulsion. The distillation residue of the modified emulsion shall contain a minimum of 3.0 percent polymer by mass, as determined by an analytical method approved by the Department. The emulsion supplier shall furnish the Department samples of the base asphalt and polymer used in the finished emulsion.

In addition, the emulsion shall be homogeneous, shall show no separation of polymer and shall comply with the following requirements:

	Min	
C, Sec. Max		
Viscosity, Saybolt Furol at 25 C, Sec.	20	100
Storage stability test, one day, percent	-	1
Particle charge test	Positive	
Sieve test, percent	-	0.1
*Distillation:		
Oil distillate, by volume of emulsion, percent	-	1/2
Residue, percent	62	-

Tests on Residue from Distillation:

Penetration, 25 C, 100 g, 5 seconds (0.1 mm)	55	90
Ductility, 25 C, 50 mm/min, mm	700	-
Solubility in trichloroethylene, percent	97	-
Softening Point, R. & B., C	57	-

*The standard distillation procedure shall be modified as follows:

The temperature on the lower thermometer shall be brought slowly to 177 C plus or minus 5 C and maintained at this point for 20 minutes. Complete the total distillation in 60 plus or

minus 5 minutes from the first application of heat.

(2) Mineral Aggregate.

- (a) Description. The mineral aggregate shall all be generated by crushing operations from a single source and shall be composed of clean, tough and durable particles of crushed traprock, crushed granite, crushed sandstone or other material approved by the Engineer. A sand equivalent of equivalent of 70 or higher is required unless otherwise shown on the plans. The aggregate shall show a maximum weighted loss of 30 percent when subjected to five (5) cycles of conditioning using magnesium sulfate solution in accordance with Test Method Tex-411-A. The test shall be performed on the gradation to be used on the project.

The polish value for the aggregate shall not be less than the value shown on the plans when tested in accordance with Test Method Tex-438-A. The polish value test shall be performed on the parent rock. The Engineer may waive the polish value requirement for aggregates with known satisfactory performance history based on Department skid values.

- (b) Grades. When tested by Test Method Tex-200-F, Part II, Washed Sieve Analysis, the gradation requirements shall be as follows:

Grade 1 (Fine Graded Surface Course)	Percent Aggregate By Mass
Retained on 9.5 mm sieve	0
Retained on 4.75 mm sieve	0-2
Retained on 2.36 mm sieve	10-25
Retained on 1.18 mm sieve	25-50
Retained on 600 micrometer sieve	50-70
Retained on 300 micrometer sieve	65-82
Retained on 150 micrometer sieve	79-90
Retained on 75 micrometer sieve	85-95

Grade 2 (Coarse Graded Surface Course)	Percent Aggregate By Mass
Retained on 12.5 mm sieve	0
Retained on 9.5 mm sieve	0-1
Retained on 4.75 mm sieve	6-14
Retained on 2.36 mm sieve	35-55
Retained on 1.18 mm sieve	54-75
Retained on 600 micrometer sieve	65-85
Retained on 300 micrometer sieve	75-90
Retained on 150 micrometer sieve	82-93
Retained on 75 micrometer sieve	85-95

- (c) Mineral Filler. Mineral filler shall be non-air-entrained Portland cement which is free of lumps or foreign matter.
- (3) Water. The water shall be potable and shall be free of harmful soluble salts.
- (4) Other Additives. With the approval of the Engineer, additives approved by the emulsion manufacturer may be added to the

emulsion mix or to any of the component materials to provide control of the set time in the field.

3. Paving Mixture.

(1) Mixture Design.

The mixture design, or job mix formula shall be supplied by the Contractor. Laboratory mixing and curing procedures shall be as outlined in Test Method Tex-230-F. The emulsified asphalt content will be selected by the Engineer to provide an optimum laboratory compacted density within the range of 92 to 95 percent when evaluated in accordance with Test Method Tex-204-F in conjunction with Test Method Tex-227-F. Hveem stability will be required only when a minimum value is shown on the plans. These mix design requirements are subject to verification by testing of laboratory produced mixes or trial batch material prior to placement of project material.

- (2) Composition of Mixture. The polymer modified micro-surfacing shall consist of a uniform mixture of aggregate and CSS-1P emulsion and mineral filler, water and field control additive as required. The emulsion and aggregate must be compatible so that a complete, uniform coating of the aggregate will be obtained in the mixing process. The mixture must have sufficient working life to allow for proper placement at the existing ambient temperature and humidity. When the paving mixture is placed with the relative humidity at not more than 50 percent and ambient air temperature of at least 25 C, it must cure sufficiently that uniformly moving traffic can be allowed in one hour with no damage to the surface. Locations subject to sharp turning or stopping and starting traffic may require additional curing.

The job mix formula shall meet with the approval of the Engineer; and the proportions to be used shall be within the following limits:

Residual Asphalt	- 6.0 to 9.0 percent by mass of dry aggregate
Mineral Filler (Portland Cement)	- 0.5 to 3.0 percent by mass of dry aggregate
Field Control Additive	- As required to provide control of break and cure
Water	- As required to provide proper consistency

The mixture shall be designed so that the mineral aggregate will produce a gradation which conforms to the limitations for the master grading for the type specified herein. The gradation will be determined in accordance with Test Method Tex-200-F (Washed Sieve Analysis) and shall be based upon aggregate and mineral filler.

- (3) Determination of Mixture Composition and Tolerances: Determination of aggregate gradation may be based on sieve analysis of representative samples taken from the stockpile at the job site. The amount of mineral filler added to the mix

shall be included in determining the total minus 75 micrometer aggregate fraction. The asphalt content may be determined in accordance with Test Method Tex-228-F. Alternately, aggregate gradation and asphalt content may be determined by Test Method Tex-210-F. If Test Method Tex-210-F is used, an asphalt retention factor must be established.

Mix samples will be taken from the mixing unit discharge in a manner such that the complete discharge stream is included in the sample. Mix samples shall be dried to constant mass at 110 C plus or minus 5 C prior to determination of asphalt content and aggregate gradation. The aggregate portion of the paving mixture produced shall not vary from the design gradation by more than the tolerances which follow. The material passing the 75 micrometer sieve is further restricted to conform to the limitations for the master grading for the type specified. The residual asphalt content of the paving mixture shall not vary from the design amount by more than the allowed tolerance and is also restricted to conform to the master limits.

	Percent by Mass or Volume as Applicable
Passing 9.5 mm sieve, retained on 4.75 mm sieve	Plus or minus 5
Passing 4.75 mm sieve, retained on 2.36 mm sieve	Plus or minus 5
Total retained on 2.36 mm sieve	Plus or minus 5
Passing 2.36 mm sieve, retained on 1.18 mm sieve	Plus or minus 3
Passing 1.18 mm sieve, retained on 600 micrometer sieve	Plus or minus 3
Passing 600 micrometer sieve, retained on 300 micrometer sieve	Plus or minus 3
Passing 300 micrometer sieve, retained on 150 micrometer sieve	Plus or minus 3
Passing 150 micrometer sieve, retained on 75 micrometer sieve	Plus or minus 3
Passing 75 micrometer sieve	Plus or minus 2
Residual Asphalt Content	Plus or minus 0.5 by mass

4. Equipment. All equipment for the handling of all materials and mixing and placing of the mixture shall be maintained in good repair and operating condition and is subject to the approval of the Engineer. Any equipment found to be defective and potentially affecting the quality of the paving mixture shall be replaced. All scales used in weighing aggregate and emulsion shall conform to the requirements of Item 520, "Weighing and Measuring Equipment".

The material shall be mixed by a self-propelled micro-surfacing mixing machine which shall be a continuous flow mixing unit able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, field control additive and water to a revolving multi-blade mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, field control additive and water to maintain an adequate supply to the proportioning controls. The machine shall be equipped with self loading devices which provide for the loading of all materials while continuing to lay micro-surfacing, thereby minimizing construction joints. The machine shall be equipped with opposite side driving stations to optimize longitudinal alignment. The machine shall be 1 equipped to allow the mix operator to have full hydrostatic control

of the forward and reverse speed during application of the micro-surfacing material.

Individual volume or mass controls for proportioning each material to be added to the mix shall be provided. Each material control device shall be calibrated and properly marked. The aggregate feed to the mixer shall be equipped with a revolution counter or similar device so the amount of aggregate used may be determined at any time. The emulsion pump shall be a positive displacement type and shall be equipped with a revolution counter or similar device so that the amount of emulsion used may be determined at any time.

The mixing machine shall be equipped with a water pressure system and nozzle type spray bar to provide a water spray immediately ahead of and outside the spreader box. It also shall be equipped with an approved fines feeder that shall provide a uniform, positive, accurately metered, predetermined amount of the specified mineral filler.

5. Stockpiling and Storage.

- (1) Aggregate Storage. If the mineral aggregates are stored or stockpiled, they shall be handled in such a manner as to prevent segregation, mixing of the various materials or sizes, and contamination with foreign materials. The grading of aggregates proposed for use and as supplied to the mixing plant shall be uniform. Suitable equipment of acceptable size shall be furnished by the Contractor to work the stockpiles and prevent segregation of the aggregates. The aggregate shall be passed over a scalping screen prior to transfer to the micro-surfacing mixing machine to remove oversize material.
- (2) Storage of Asphaltic Materials. The asphaltic material storage shall be ample to meet the requirements of the plant. All equipment used in the storage and handling of asphaltic material shall be kept in a clean condition at all times and shall be operated in such manner that there will be no contamination with foreign matter.

6. Construction Methods.

- (1) General. It shall be the responsibility of the Contractor to produce, transport, and place the specified paving mixture in accordance with these specifications and as approved by the Engineer. The finished micro-surfacing shall have a uniform texture free from excessive scratch marks, tears or other surface irregularities. The cured mixture shall adhere fully to the underlying pavement.
- (2) Weather Limitations. The material shall be spread only when the atmospheric temperature is at least 10 C and rising and the weather is not foggy or rainy and there is no forecast of temperatures below 0 C within 24 hours after mix placement.
- (3) Surface Preparation. The area to be surfaced shall be thoroughly cleaned of all vegetation, loose aggregate and soil. Water used in pre-wetting the surface ahead of and outside the spreader box shall be applied at a rate to dampen the entire surface without any free flowing water ahead of the spreader box.

- (4) Spreading Equipment. The paving mixture shall be spread uniformly by means of a mechanical type spreader box attached to the mixer, equipped with paddles or other devices to agitate and spread the materials throughout the box. The spreader box used must be capable of obtaining the desired lines and grade as shown on the plans. A front seal shall be provided to insure no loss of the mixture at the road contact surface. The rear seal shall act as a strike off and shall be adjustable. A secondary strike off shall be provided to improve surface texture. The secondary strike off shall have the same adjustments as the rear seal. The mixture shall be spread to fill cracks and minor surface irregularities and leave a uniform skid resistant application of aggregate and asphalt on the surface. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The seam where two spreads join shall be neat appearing and uniform.
- (5) Ruts. When required on the plans, before the final surface course is placed, preliminary micro-surfacing material shall be required to fill ruts, utility cuts, depressions in the existing surface, etc. Ruts of 13 millimeters or greater depth shall be filled independently with a rut filling spreader box either 1.5 meters or 1.8 meters in width. For irregular or shallow rutting less than 13 millimeters depth, a full-width scratch coat pass may be used as directed by the Engineer. Each individual rut fill, utilizing a rut filling spreader box shall be crowned to compensate for traffic compaction. Ruts that are in excess of 40 millimeters depth may require multiple placements with the rut filling spreader box to restore the original cross section.
- (6) Workmanship. No excessive buildup, uncovered areas or unsightly appearance will be permitted on longitudinal or transverse joints. Longitudinal joints shall be placed on lane lines. Excessive overlap will not be permitted. Care shall be taken to insure straight lines along the roadway centerline, lane lines, shoulder or curb lines. Lines at intersections will be kept straight to provide a good appearance.

Areas which cannot be reached with the mixing machine shall be surfaced using hand tools to provide complete and uniform coverage. The area to be handworked shall be lightly dampened prior to mix placement. Care shall be exercised in areas that require handwork so that the finished surface is uniform in texture, dense and of overall good appearance comparable to that produced by the spreader box. Micro-surfacing material required to repair deficiencies due to unsatisfactory workmanship shall not be paid for but shall be entirely at the Contractor's expense.

~~7. Measurement. This item will be measured by the megagram of the composite "Micro Surfacing (Polymer Modified)". The composite micro surfacing (polymer modified) mixture is hereby defined as the asphalt emulsion, aggregate and additives.~~

- ~~(1) Aggregate. The quantity of aggregate used in the accepted portions of the work shall be measured by net ticket mass of each individual load of aggregate shipped to the project based on dry mass of aggregate. The aggregate will be weighed at the Contractor's stockpile site. The weighing equipment can be~~

~~either a suspended hopper or a belt scale meeting the requirements of Item 520. The mass of mineral filler used shall be calculated and included in the total aggregate mass.~~

~~(2) Polymer Modified Asphalt Emulsion. The quantity of polymer modified asphalt emulsion in the accepted portion of the work shall be measured by megagram of material based on the accepted load tickets issued from the manufacturer. At the completion of the project any unused emulsion shall be weighed back and that quantity deducted from the accepted asphalt emulsion quantity delivered.~~

~~8. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Micro surfacing (Polymer Modified)", of the grade specified. This price shall be full compensation for furnishing all materials and performing all operations necessary to complete the work.~~

7. Trial Application.

Prior to apply the slurry seal, a test section at least 60 meters long and 6 meters wide shall be placed by the Contractor using the approved materials. The slurry seal shall be placed and rolled in accordance with the specified requirements. Tests shall be made to determine the asphalt cement and moisture contents and the aggregate gradation. If test results are satisfactory, the test section shall remain in place as part of the completed slurry seal. If tests indicate that the slurry seal does not conform to specification requirements, necessary adjustments to the slurry seal machine and application procedures shall be made immediately, and additional test sections shall be constructed and samples shall be taken and tested for conformance with specification requirements. If tests indicate that the slurry seal does not conform to specification requirements, the test section shall be removed at no cost to the Government, and the material disposed of off-site. In no case shall the Contractor start full production of slurry seal without approval.

[AM#2]8. Application.

- (1) Application rate. The microsurfacing application rate shall be a minimum of 15.65 kg/m³. The gradation shall be in accordance with TxDOT Specification 3138.
- (2) Transition. Apply a smooth transition at the interface of the runway and taxiways, and at the interface of taxiway to taxiway. The smooth transitions shall have absolutely no bumps and shall drain properly to avoid all ponding in this area.

SECTION 07416A

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

10/01

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M (2000) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM B 117 (1997) Operating Salt Spray (Fog) Testing Apparatus

ASTM C 991 (1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings

ASTM C 1289 (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 522 (1993a) Mandrel Bend Test of Attached Organic Coatings

ASTM D 523 (1989; R 1999) Specular Gloss

ASTM D 968 (1993) Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM D 1308 (1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes

ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 2244 (1995) Calculation of Color Differences

	from Instrumentally Measured Color Coordinates
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 1592	(1998) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1998) Minimum Design Loads for Buildings and Other Structures
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1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.2.1 Structural Standing Seam Metal Roof (SSSMR) System

The SSSMR system covered under this specification shall include the entire roofing system; the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system.

1.2.2 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing and designing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.2.3 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

1.3 DESIGN REQUIREMENTS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.3.1 Design Criteria

Design criteria shall be in accordance with ASCE 7.

1.3.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

1.3.3 Live Loads

1.3.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 300 pound concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.3.3.2 Uniform Loads

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 20 psf.

1.3.4 Wind Loads

The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

- a. Single fastener in each connection.....3.0
- b. Two or more fasteners in each connection...2.25

1.3.5 Thermal Loads

Roof panels shall be free to move in response to the expansion and

contraction forces resulting from a total temperature range of 200 degrees F during the life of the structure.

1.3.6 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with AISI Cold-Formed Mnl. Maximum deflection under applied live load, snow, or wind load shall not exceed $1/180$ of the span length.

1.3.7 Roof Panels Design

Steel panels shall be designed in accordance with AISI Cold-Formed Mnl. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed $1/180$ of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed $1/180$ times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

1.3.8 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of $3/8$ inch will be allowed when the supporting structural members are prepunched or predrilled.

1.4 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 30 inches. Test 2 shall simulate the interior condition with both ends free of crosswise restraint.

The maximum span length for the interior condition shall be 5.0 feet. External reinforcement, such as clamps on the ribs, shall not be installed to improve uplift resistance. Bolts through seams shall not be installed.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Drawings

Structural Standing Seam Metal Roof System; G, .

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the metal roofing manufacturer.

SD-03 Product Data

Design Analysis; G, .

Design analysis signed by a Registered Professional Engineer employed by the SSSMR manufacturer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components; valley designs, gutter/downspout calculations, screw pullout test results, and shall indicate how expected thermal movements are accommodated.

Qualifications; G.

Qualifications of the manufacturer and installer.

SD-04 Samples

Accessories; G.

One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; G.

One piece of each type to be used, 9 inches long, full width.

Factory Color Finish; G, A.

Three 3 by 5 inches samples of each type and color.

Fasteners; G.

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Insulation; G.

One piece, 12 by 12 inches, of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

Gaskets and Insulating Compounds; G.

Two samples of each type to be used and descriptive data.

Sealant; G.

One sample, approximately 1 pound, and descriptive data.

Concealed Anchor Clips; G.

Two samples of each type used.

Subpurlins; G.

One piece, 9 inches long.

EPDM Rubber Boots; G.

One piece of each type.

SD-06 Test Reports

Test Report for Uplift Resistance of the SSSMR; G, .

The report shall include the following information:

- a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.
- b. Details of the anchor clip, dimensions, and thickness.
- c. Type of fasteners, size, and the number required for each connection.
- d. Purlins/subpurlins size and spacing used in the test.
- e. Description of the seaming operation including equipment used.
- f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.
- g. Any additional information required to identify the SSSMR system tested.
- h. Signature and seal of an independent registered engineer who witnessed the test.

SD-07 Certificates

Structural Standing Seam Metal Roof System; G.

- a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified requirements.

b. Certification that materials used in the installation are mill certified.

c. Previous certification of SSSMR system tested under the Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.

d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.

e. Certification of installer. Installer certification shall be furnished.

f. Warranty certificate.

(1) Submit samples of Contractor's Weathertightness Warranty bond, 20-year Manufacturer's Material Warranties, And Manufacturer's 20-year system weathertightness warranty.

(2) At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy which is attached to this section, 5-year Weathertightness Warranty Bond, and the 20-year Manufacturer's Material Warranties, and the manufacturer's 20-year system weathertightness warranty.

Insulation; G.

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and

trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, and exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of these specifications that are part of the SSSMR system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.

c. A roofing system manufacturer's 20 year system weathertightness warranty.

1.8 COORDINATION MEETING

A coordination meeting shall be held 30 days prior to the first submittal, for mutual understanding of the Structural Standing Seam Metal Roof (SSSMR) System contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roof system manufacturer, the roofing supplier, the erector, the SSSMR

design engineer of record, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 30 feet. When length of run exceeds 30 feet and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 100 feet may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 24 inches of coverage in place. SSSMR system with roofing panels greater than 12 inches in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than [AM#2] 2 inches for rolled seam.

2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 50 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Zinc, zinc-aluminum alloy or aluminum coated panels shall be 0.023 inch thick minimum. Panels shall be within 95 percent of reported tested thickness as noted in wind uplift resistance testing required in paragraph PERFORMANCE REQUIREMENTS.

2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products with the exception that their metal thickness shall match that of the panels furnished. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water. The use of a continuous angle butted to the panel ends to form a closure will not be allowed.

2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear

ultimate strengths of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the roof to waterproof the fastener penetration. Washer material shall be compatible with the roofing; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick.

Poprivets shall be non-leaking, enclosed-stem type. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 Bolts

Bolts shall be not less than 1/4 inch diameter, shouldered or plain shank as required, with locking washers and nuts.

2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 1/4 inch diameter. Blind (pop) rivets shall be not less than 9/32 inch minimum diameter.

2.5 PURLINS AND SUBPURLINS

Cold formed supporting structural members/subpurlins shall have a minimum thickness of 0.059 inches and a minimum tensile yield strength of 50000 psi.

Hot rolled structural members shall have a minimum thickness of 0.25 inches and a minimum tensile yield strength of 36000 psi. Subpurlins shall be shop painted.

2.6 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated in Section 09915 COLOR SCHEDULE. The exterior coating shall be a nominal 1 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thickness. The interior color finish shall consist of a backer coat with a dry film thickness of . The exterior color finish shall meet the test requirements specified below.

2.6.1 Salt Spray Test

A sample of the sheets shall withstand a SALT SPRAY test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few No. 8 blisters and a rating of 6, 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.6.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

2.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B for 1000 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244.

2.6.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no cracking.

2.6.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.6.7 Specular Gloss

Finished roof surfaces shall have a specular gloss value of 30 plus or minus 5 at 60 degrees when measured in accordance with ASTM D 523.

2.6.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.7 INSULATION

Thermal resistance (R-Value) of insulation shall be not less than 30 hour x square feet x degree F/BTU. Thickness of polyisocyanurate insulation shall be determined by using an aged R-Value of 5.56 hour x square feet x degree F/BTU per inch of insulation. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation ,

including facings, shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 450 when tested in accordance with ASTM E 84.

2.7.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II, (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). 7.2. Facings shall be non-asphaltic, glass fiber reinforced.

2.7.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991.

2.8 STEEL SUPPORT PLATES

Provide 16 gauge minimum support plate at all valleys as indicated on the drawings.

2.9 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be polyurethane based, colored to match the applicable building color, and shall cure to a rubberlike consistency. Factory - installed sealant shall be provided in the standing seam ribs.

2.10 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.11 GUTTERS AND DOWNSPOUTS

Provide 24 gauge minimum gutters and downspouts per drawings of the same material, color to match adjacent composite foam insulated metal wall panels.

2.12 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

2.13 PREFABRICATED CURBS AND EQUIPMENT SUPPORTS

Prefabricated curbs and equipment supports shall be of structural quality, hot-dipped galvanized or galvanized sheet steel, with mitered and welded joints. Finish shall be the same as provided on the roof panels. Integral base plates and water diverter crickets shall be provided. Minimum height of curb shall be 8 inches above finish roof. Curbs shall be constructed to match roof slope and to provide a level top surface for mounting of equipment. Curb flange shall be constructed to match configuration of roof panels. Curb size shall be coordinated, prior to curb fabrication, with the mechanical equipment to be supported. Strength requirements for

equipment supports shall be coordinated to include all anticipated loads. Flashings shall not be rigidly attached to underline structure.

2.14 UNDERLAYMENTS

Rubberized underlayment shall be equal to TW metal and tile underlayment by TAMKO WATERPROFFING or Stormguard HT manufactured by GAF Materials Corporation. Underlayment shall be resistant to damage from UV radiation for a minimum of 60 days when exposed to the weather.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Field Forming of Panels for Unique Area

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's representative. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

3.1.2 Purlins and Subpurlins

Purlins and subpurlins shall be anchored to the structural metal deck with bolts or screws. The purlin spacing shall not exceed 30 inches on centers at the corner, edge and ridge zones, and 5 foot maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in ASCE 7.

3.1.3 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture

roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.

3.1.4 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural deck. The maximum distance, parallel to the seams, between clips shall be 30 inches on center at the corner, edge, and ridge zones, and 5 feet maximum on centers for the remainder of the roof.

3.2 INSULATION INSTALLATION

Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation with vapor retarder providing equivalent R-value and perm rating as remaining insulation. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

3.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. Board shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, and shall have a minimum of 1 fastener per 4 square feet. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer.

3.3 BLANKET INSULATION

Install rubberized underlayment at all roof edges, hips, valleys and under all roof panels. Install directly over the insulation and purlins, beneath the metal roof panels. All underlayments shall be installed so that successive strips overlap the neat lower strip in shingle fashion. Underlayment shall be installed in accordance with manufacturer's written instructions.

3.4 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

FACILITY DESCRIPTION_____

BUILDING NUMBER:_____

CORPS OF ENGINEERS CONTRACT NUMBER:_____

CONTRACTOR

CONTRACTOR:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

OWNER

OWNER:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONSTRUCTION AGENT

CONSTRUCTION AGENT:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE SSSMR SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

★ ★

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

**REPORTS OF LEAKS AND SSSMR SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

SECTION 07430

COMPOSITE, FOAM-INSULATED, METAL WALL PANELS

08/2002

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-673 (1986) Cold-Formed Steel Design Manual

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE-03 (1989) Handbook, Fundamentals I-P Edition

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M (1999a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus

ASTM C 984 (1994) Perlite Board and Rigid Cellular Polyurethane Composite Roof Insulation

ASTM C 1289 (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 522 (1993a) Mandrel Bend Test of Attached Organic Coatings

ASTM D 523 (1999) Specular Gloss

ASTM D 968 (1993) Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM D 1308 (1987) Effect of Household Chemicals on Clear and Pigmented Organic Finishes

ASTM D 4214 (1989) Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive

Environments

ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1997) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 119	(1998) Fire Tests of Building Construction and Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Foam Insulated Metal Panels; G.

Drawings consisting of catalog cuts, design and erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe design, materials, factory color finish, sizes, layouts, construction details, fasteners, subgirts, and erection. Drawings shall be accompanied by engineering design calculations for the structural properties of roofing and siding units.

SD-03 Product Data; G.

Include descriptive literature, detailed specifications, and available performance test data.

SD-04 Samples

Foam Insulated Metal Panels; G.

One piece of each type and finish (exterior and interior) to be used, 9 inches long, full width.

Accessories; G.

One sample of each type of flashing, trim, closures, caps and similar items. Size shall be sufficient to show construction and configuration.

Fasteners; G.

Two samples of each type to be used with statement regarding intended use.

If so requested, random samples of bolts, nuts, and washers as

delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Sealant; G.

One container of sealant, with installation instructions.

SD-05 Design Data

Calculations

SD-06 Test Reports

Factory Color Finish; G.

Certified laboratory test report containing the results of testing of at least 5 samples identical to the specified finish. All samples shall pass tests specified under the paragraph "FACTORY COLOR FINISH".

Fire Resistive Rating; G.

Certified test reports substantiating that the fire resistive rating of wall panels of the type to be installed in the exterior walls will be maintained for the hourly rating of the walls. Testing shall be in accordance with ASTM E 119.

SD-07 Certificates

Foam Insulated Metal Panels; G.

Certificates attesting that the panels and accessories furnished conform to the requirements specified.

SD-11 Closeout Submittals

Warranties; G.

Provide the Contractor and manufacturer's warranties specified in Part 1 paragraph QUALITY ASSURANCE.

1.3 DESIGN

Contract drawings indicate extent and general assembly details of the composite metal, foam insulated wall panels. Members and connections not indicated on drawings shall be designed by the Contractor. Panels shall be designed to provide the minimum section properties shown. Wall panels shall be designed to resist a wind load of 67 psf without exceeding a deflection of 1/180th of the span. Steel face sheets shall be designed in accordance with the AISI SG-673.

1.4 QUALITY ASSURANCE

In addition to the WARRANTY OF CONSTRUCTION paragraph in Section 00800 SPECIAL CONTRACT REQUIREMENTS provide the following warranties. The warranties shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier:

a. The Contractor shall provide a weather tight warranty for the metal wall panels for a period of 20 years to include panel assembly;

b. the panel manufacturer shall provide a warranty for a period of 10 years against the wear of color finish; and

c. the panel manufacturer shall warrant for three years that the occurrence of thermal blistering shall not exceed the rate of one for every 900 square feet of wall or roof area. Blisters occurring within the warranty period shall be repaired by the panel manufacturer at no additional cost to the Government. When the number of blisters exceed the specified limit above, panels, as selected by the Contracting Officer, shall be replaced by new panels until the number of blisters is within the specified limit. Individual panels having two or more blisters shall be replaced at no additional cost to the Government. The warranty period shall commence upon the date of final acceptance of the project or the date of beneficial occupancy whichever is earlier.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for roof and wall covering shall provide good air circulation and protection from surface staining.

PART 2 PRODUCTS

2.1 FOAM INSULATED METAL PANELS

Panels shall be factory-fabricated units with a foamed-in-place polyurethane or polyisocyanurate insulating core between steel face sheets.

Panels shall be square cut, factory color finished, and have the following features or properties:

a. Panel Dimensions:

Wall panels: 2-1/2 inches thick x 24, 30 or 36 inches wide

b. Exterior Surface Profile & Texture:

Wall Panels - Stucco embossed with flutes parallel to ground plane as shown on the drawings.

c. Interior Surface Profile: Smooth

Wall Panels - Fluted, stucco embossed as shown on the drawings.

d. U-value: The coefficient of heat transmission or U-value, Btu per hour, per square foot, per degree F temperature difference, through the completed panel system, including panel joints, air to air, shall not exceed .0526 (R19) for wall panels when determined for winter conditions in accordance with recognized methods in agreement with ASHRAE-03. The U-value, and therefore the required thickness of the panel, shall be calculated by using a K-value of 0.16 for the insulation.

e. Fire Resistance:

(1) The entire panel assembly shall have a flame spread rating not higher than 25 and a smoke developed rating not higher than 150 when tested in accordance with ASTM E 84.

(2) Panels shall be approved by Factory Mutual for metal-faced Class 1 fire-rated construction.

f. Surface Flatness: Panels shall have a minimum flatness deviation of 0.03-inch in a 12 inch span in any direction.

h. Length: Length of panels shall be sufficient to cover the entire length of any unbroken wall surface when such length is 50 feet or less. When length of run exceeds 50 feet, each panel in the run shall extend over two or more spans. Panels longer than 50 feet may be furnished if approved by the Contracting Officer.

i. Expansion and Contraction: Design provisions shall be made for expansion and contraction at the panel joints and at either the ridge or eave.

j. Panel Joints: Panel side joint shall be of a tongue-and-groove and shiplap design, permitting the use of fasteners, installed from the exterior, that are completely concealed within the side joint. The interior and exterior joints shall be factory caulked. The fastener shall lock the face sheet of the panel to the structural supports, and provide positive resistance to negative load pull-off. Exposed fasteners are not acceptable. Exposed wet sealants are not acceptable.

2.1.1 Face Sheets

Zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 55 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Face sheets shall be 0.030-inch (22-gage) thick minimum.

2.1.2 Insulation

Insulation shall conform to the applicable portions of ASTM C 984 or ASTM C 1289, shall be compatible with adjoining materials, be capable of retaining its U-value for the life of the metal facing sheets, and be unaffected by extremes of temperature and humidity. Insulation shall remain odorless, free from mold, and not become a source of food and shelter for insects.

2.1.3 Thermal Blistering Test

Sample panels shall be factory tested at the rate of three panels per each day's production run. Panels shall be selected at random. The test shall expose the exterior side of the panel to heat at a temperature of 180 degrees F for one hour. The day's production run will not be acceptable if blistering occurs to more than one panel. Sample panels shall be free of blisters prior to the time the test is performed.

2.1.4 Factory Color Finish

Wall panels shall have a factory color finish on the exposed sides. The exterior and interior finish shall consist of a polyvinylidene fluoride coating. Color shall be as specified in Section 09000 BUILDING COLOR AND FINISH SCHEDULE. [AM#2] The exterior coating shall be a nominal 1 mil

thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thickness. The interior and exterior color finish shall meet the test requirement specified below. The manufacturer shall have conducted tests on previously manufactured panels of the same type and finish as proposed for the project. The term "appearance of base metal" refers to the metal coating on steel base metal.

2.1.4.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating [AM#2] of not less than 8F, few No. 8 blisters and a rating of 6, 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.1.4.2 Formability Test

When subjected to a 180-degree bend over a [AM#2] 1/8-inch diameter mandrel in accordance with ASTM D 522, exterior coating film shall show no evidence of fracturing to the naked eye.

2.1.4.3 Accelerated Weathering, Chalking Resistance and Color Change

[AM#2] A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B for 1000 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244.

2.1.4.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of [AM#2] blistering, cracking, creepage, or corrosion [AM#2] _____.

2.1.4.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 equal to 1.5 times metal thickness in millimeters mils expressed in inch-pounds, with no loss of adhesion.

2.1.4.6 Abrasion Resistant Test

When subjected to the falling sand test in accordance with ASTM D 968 the coating system shall withstand a minimum of [AM#2] 50 liters of sand before the appearance of the base metal.

2.1.4.7 Specular Gloss

Finished surfaces shall have a specular gloss value of [AM#2] 20 or less at an angle of 60 degrees when measured in accordance with ASTM D 523. Low gloss may be obtained with striations or embossing.

2.1.4.8 Pollution Resistance Test

Coating shall show no visual effects when immersion tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.2 ACCESSORIES

Accessories shall be compatible with the panels furnished. Flashing, trim for top and bottom of wall, corners, treatment at fenestrations and roof ridges, molded closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for the panel face sheets. Accessories shall be furnished by the panel manufacturer and shall be compatible with the panels furnished. Exposed metal accessories shall have a factory color finish to match the panels furnished. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water.

2.3 FASTENERS

Fasteners shall be the type recommended and furnished by the panel manufacturer.

2.4 SEALANT

Sealant shall be the type conforming to the manufacturer's recommendation for factory application. Concealed sealant may be the non-hardening type.

2.5 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be non-absorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be non-running after drying.

PART 3 EXECUTION

3.1 GENERAL

Installation shall be as specified and in accordance with the approved erection instructions and drawings. Finished structure shall be proven weathertight. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign materials. Stained, discolored, or damaged sheets shall be removed from the site.

3.2 PANEL INSTALLATION

Wall panels shall be applied with the longitudinal configurations in the horizontal position. Joints between panels and at accessories shall be sealed. Method of applying joint sealant shall conform to the manufacturer's recommendations. Fasteners shall be driven normal to the surface and to a uniform depth to seat properly. Accessories shall be fastened into framing members, except as otherwise approved. Scratched, chipped or otherwise abraded surfaces shall be touched up as necessary with the manufacturer's recommended touch-up paint. Closure strips shall be provided as indicated and where necessary to provide weathertight

construction.

3.3 THERMAL BLISTERING

When thermal blistering occurs, all repairs shall be made in accordance with the panel manufacturer's instructions and supervision, and with the written approval of the Contracting Officer. Location of all repairs shall be indicated on the contract drawings. In areas where blistering occurs, panels shall be relocated so that no two panels having repaired blisters shall be next to each other.

3.3.1 Blisters Less Than 12 Inches in Diameter

A small hole shall be drilled in the blistered area to release the freon gas. If this procedure does not restore the panel's flat appearance, then adhesive shall be injected into the blister to re-adhere the facing to the insulation.

3.3.2 Blisters Greater Than 12 Inches in Diameter

Adhesive shall be injected into the blister pocket to restore the structural integrity and the flat appearance.

-- End of Section --

SECTION 08120

ALUMINUM DOORS AND FRAMES

03/94

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1503.1 (1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209 (1996) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM E 283 (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E 330 (1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

ASTM E 331 (1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

1.2 SYSTEM DESCRIPTION

Swing-type aluminum doors and frames, of size and design shown on the drawings, shall be provided at the locations indicated. Doors shall be furnished complete with frames, subframes, transoms, adjoining sidelights, trim, and other accessories indicated and specified. Adjoining sidelights shall have horizontal safety rails..

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Wind Load Performance

Doors and frames shall be of sufficient strength to withstand a design wind load of 30 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member. Doors shall be tested

in accordance with ASTM E 330 at a pressure not less than 1.5 times the design load.

1.3.2 Water Penetration Performance

Frames and fixed areas, and non-handicap complying doors shall have no water penetration when tested in accordance with ASTM E 331 at a pressure of 8 psf.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Aluminum Doors and Frames; FIO.

Manufacturer's descriptive data and catalog cuts including air-infiltration data.

SD-04 Drawings

Aluminum Doors and Frames; GA.

A schedule showing the location of each door shall be included with the drawings. Drawings showing elevations of each door and frame type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, and details of joints and connections.

SD-06 Instructions

Installation; FIO. Cleaning; FIO.

Manufacturer's installation instructions and cleaning instructions.

SD-09 Reports

Full-Glazed and Flush Doors; FIO.

For full-glazed and flush doors, certified test reports from an independent testing laboratory, stating that doors are identical in design, materials, and construction to a door that has been tested and meets all test and specified requirements.

SD-14 Samples

Finishes; GA.

Samples of the color anodized coating, showing the extreme color range.

1.5 DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspecting and handling. Materials shall

be neatly stored on the floor, properly stacked on nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

PART 2 PRODUCTS

2.1 ALUMINUM DOORS AND FRAMES

Extrusions shall comply with ASTM B 221, Alloy 6063-T5 except alloy used for anodized color coatings shall be required to produce the specified color. Aluminum sheets and strips shall comply with ASTM B 209, alloy and temper best suited for the purpose. Fasteners shall be hard aluminum or stainless steel.

2.1.1 Finishes

[AM#2] All exposed surfaces shall be free of unsightly scratches and blemishes. The coating shall be factory applied, oven baked by an approved applicator specifically qualified by the paint manufacturer. No field application. The exposed sections shall receive an alodine pre-treatment followed by a painted coating. The coating shall be a resin based paint conforming with AAMA #2605 and/or #2603 specifications.

2.1.2 Welding and Fastening

Where possible, welds shall be located on unexposed surfaces. Welds required on exposed surfaces shall be smoothly dressed. Welding shall produce a uniform texture and color in the finished work, free of flux and spatter. Exposed screws or bolts will be permitted only at inconspicuous locations and shall have heads countersunk.

2.1.3 Anchors

Anchors shall be stainless steel or steel with a hot-dipped galvanized finish. Anchors of the sizes and shapes required shall be provided for securing aluminum frames to adjacent construction. Anchors shall be placed 400 mm near top and bottom of each jamb and at intermediate points not more than 25 inches apart as indicated on the drawings. Transom bars shall be anchored at ends, and mullions shall be anchored at head and sill.

2.1.4 Provisions For Hardware

Hardware for aluminum doors is specified in Section 08700 BUILDERS' HARDWARE. Doors and frames shall be cut, reinforced, drilled, and tapped at the factory to receive template hardware. Reinforcement shall be provided in the core of doors as required to receive locks, door closers, and other hardware. Doors to receive surface applied hardware shall be reinforced as required.

2.1.5 Provisions For Glazing

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Metal glazing beads, vinyl inserts, and glazing gaskets shall be provided for securing glass, minimum glass bite along perimeter of frame shall be 13mm.

Glass stops shall be tamperproof on exterior side.

2.1.6 Weatherstripping

Weatherstripping shall be continuous silicone-treated wool pile type, or a type recommended by the door manufacturer, and shall be provided on head and jamb of exterior doors. Weatherstripping for bottom of doors shall be as shown. Weatherstripping shall be easily replaced without special tools, and shall be adjustable at meeting stiles of pairs of doors. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.2 FABRICATION OF ALUMINUM FRAMES

Frames shall be double-glazed and shall have a minimum total average unit thermal resistance of R value 1.92. Frames shall be fabricated of extruded aluminum shapes to contours as shown on the drawings. Shapes shown are representations of design, function, and required profile. Dimensions shown are minimum. Shapes of equivalent design may be submitted, subject to approval of samples. Minimum metal wall thickness shall be 0.090 inch, except glazing beads, moldings, and trim shall be not less than 0.050 inch. Frames that are to receive glass shall have removable snap-on glass stops and glazing beads. Joints in frame members shall be milled to a hairline watertight fit, reinforced, and secured mechanically by steel clip arrangement or by screw spline attachment.

2.2.1 Horizontal Safety Rails

Rails shall be of the same style, design, and finish as the doors and frames, and shall be mounted at the same height as push-pull bars and exit devices. Rails may be on either side of the glass. The exposed vertical face shall be not less than 38 mm (1 1/2 inches) wide

2.3 FABRICATION OF ALUMINUM DOORS

2.3.1 Sizes, Clearances, and Edge Treatment

Doors shall be not less than 1-3/4 inchesthick. Clearances shall be 1/16 inch at hinge stiles, 1/8 inch at lock stiles and top rails, and 3/16 inch at floors and thresholds. Single-acting doors shall be beveled 1/8 inch at lock and meeting stile edges. Double-acting doors shall have rounded edges at hinge stile, lock stile, and meeting stile edges.

2.3.1.1 Full-Glazed Stile and Rail Doors

Doors shall have wide stiles and rails as shown, and shall be fabricated from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Doors shall be double-glazed and shall have a minimum total average unit thermal resistance of double-glazed and shall have a minimum condensation resistance factor of 45 in accordance with AAMA 1503.1. Top and bottom rail shall be fastened together by means of welding or by 3/8 inch diameter cadmium-plated tensioned steel tie rods. Extruded aluminum snap-in glazing beads shall be provided on interior side of doors. Extruded aluminum theft-proof snap-in glazing beads or fixed glazing beads shall be provided on exterior or security side of doors. Glazing beads

shall have vinyl insert glazing gaskets, designed to receive glass of thickness required. Glass is specified in Section 08810 GLASS AND GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS, FRAMES, AND ACCESSORIES

3.1.1 Protection of Aluminum

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods.

3.1.1.1 Paint

Aluminum surfaces to be protected shall be solvent cleaned and given a coat of zinc-molybdate primer and one coat of aluminum paint.

3.1.1.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and shall be cemented to the aluminum surface using a cement compatible with aluminum.

3.1.2 Installation

Frames and framing members shall be accurately set in position to receive doors, transoms, and adjoining sidelights. Frames shall be plumb, square, level, and in alignment, and securely anchored to adjacent construction. Metal-to-metal joints between framing members shall be sealed as specified in Section 07900 JOINT SEALING. Doors shall be accurately hung with proper clearances, and adjusted to operate properly. Protective coverings if provided shall be removed and the doors and frames shall be thoroughly cleaned.

-- End of Section --

SECTION 08520N

ALUMINUM WINDOWS

08/01

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101	(1997) Voluntary Specification for Aluminum, Vinyl (PVC), and Wood Windows and Glass Doors
AAMA 1302	(1976) Forced-Entry Resistant Aluminum Prime Windows
AAMA 1503.1	(1988) Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

1.2 CERTIFICATION

Each prime window unit shall bear the AAMA Label warranting that the product complies with AAMA 101. Certified test reports attesting that the prime window units meet the requirements of AAMA 101, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittals Procedures." Refer to paragraph entitled "Quality Assurance" for further submittal explanation.

SD-02 Shop Drawings

Windows; G

SD-03 Product Data

Windows; G

Hardware; G

Fasteners; G

Weatherstripping; G

Accessories; G

SD-04 Samples

Finish Sample

Window Sample

SD-05 Design Data

Structural calculations for deflection; G

SD-06 Test Reports

Minimum condensation resistance factor

Resistance to forced entry

SD-10 Operation and Maintenance Data

Windows, Data Package 1; G

Submit in accordance with Section 01781, "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Drawings shall indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, stools, casings, sills, trim, installation details, and other related items.

1.4.2 Sample Requirements

1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

1.4.2.2 Window Sample Requirements

Submit one full-size corner of each window type proposed for use. Where weatherstripping is required, fit sample with such items that are to be used.

1.4.3 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements. Calculations shall be provided by a Professional Engineer.

1.4.4 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA 101 including test size, minimum condensation resistance factor (CRF), and resistance to forced entry.

1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Damaged windows shall be repaired to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

PART 2 PRODUCTS

2.1 WINDOWS

Prime windows shall comply with AAMA 101 and the requirements specified herein. In addition to compliance with AAMA 101, window framing members for each individual lite of glass shall not deflect to the extent that deflection perpendicular to the glass lite exceeds $L/175$ of the glass edge length when subjected to uniform loads at specified design pressures. Structural calculations for deflection shall be provided to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, and accessories to be furnished. Each window shall be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 45 when tested in accordance with AAMA 1503.1.

2.1.1 Fixed Windows (F)

Type F10.

2.1.2 Forced Entry Resistant Windows

In addition to meeting the requirements of AAMA 101, windows designated for resistance to forced entry shall conform to the requirements of AAMA 1302.

2.1.3 Glass and Glazing

Materials are specified in Section 08800N, "Glazing."

2.1.4 Calking and Sealing

Are specified in Section 07920N, "Joint Sealants."

2.1.5 Weatherstripping

AAMA 101.

2.2 FABRICATION

Fabrication of window units shall comply with AAMA 101.

2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness specified.

2.2.2 Weatherstripping

Provide for ventilating sections of all windows to ensure a weather-tight seal meeting the infiltration requirements specified in AAMA 101. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do not use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sunlight.

2.2.3 Fasteners

Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16 inch thick.

2.2.4 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips shall be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

2.2.5 Combination Windows

Windows used in combination shall be the same class and grade and shall be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.6 Mullions and Transom Bars

Provide mullions between multiple window units which meet the design pressure of 40 psf. Provide mullions with a structural thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.

2.2.7 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.

2.2.7.1 Hardware

AAMA 101. The item, type, and functional characteristics shall be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.7.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners shall be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

2.2.8 Finishes

All exposed surfaces shall be free of unsightly scratches and blemishes. The coating shall be factory applied, oven baked by an approved applicator specifically qualified by the paint manufacturer. No field application. The exposed sections shall receive an alodine pre-treatment followed by a painted coating. The coating shall be a resin based paint conforming with AAMA #2605 and/or #2603 specifications.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, the aluminum surface shall be protected from dissimilar materials as recommended in the Appendix to AAMA 101. Surfaces in contact with sealants after installation shall not be coated with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls shall have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

SECTION 08900

GLAZED CURTAIN WALL

09/99

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA 1 (1997) Aluminum Standards and Data

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA MCWM-1 (1996) Metal Curtain Wall Manual

AAMA CW-10 (1997) Care and Handling of Architectural Aluminum from Shop to Site

AAMA 501 (1994) Exterior Walls

AAMA 609 (1993) Cleaning and Maintenance of Architectural Anodized Aluminum

AAMA 610.1 (1979) Cleaning and Maintenance of Painted Aluminum Extrusions and Curtain Wall Panels

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (1997; Rev. A) Carbon Structural Steel

ASTM A 123/A 123M (1997) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M (1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 167 (1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 242/A 242M (1998) High-Strength Low-Alloy Structural Steel

ASTM A 424 (1997) Steel, Sheet, for Porcelain Enameling

ASTM A 570/A 570M (1997) Steel, Sheet and Strip, Carbon,

	Hot-Rolled, Structural Quality
ASTM A 572/A 572M	(1998) High-Strength Low-Alloy Columbium-Vanadium of Structural Steel
ASTM A 588/A 588M	(1997; Rev. A) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 606	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 607	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled
ASTM A 611	(1997) Commercial Steel (CS) Sheet, Carbon, Cold-Rolled
ASTM A 653/A 653M	(1998) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 26/B 26M	(1997) Aluminum-Alloy Sand Castings
ASTM B 85	(1996) Aluminum-Alloy Die Castings
ASTM B 108	(1997) Aluminum-Alloy Permanent Mold Castings
ASTM B 136	(1984; R 1993) Measurement of Stain Resistance of Anodic Coatings on Aluminum
ASTM B 137	(1995) Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 244	(1997) Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals With Eddy-Current Instruments
ASTM C 236	(1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM C 542	(1994) Lock-Strip Gaskets
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation

ASTM C 665	(1998) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 864	(1998) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 1036	(1991; R 1997) Flat Glass
ASTM C 1048	(1997; Rev. B) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM D 1037	(1996; Rev. A) Evaluating the Properties of Wood-Base Fiber and Particle Panel Materials
ASTM E 34	(1994; R 1998) Chemical Analysis of Aluminum and Aluminum-Base Alloys
ASTM E 84	(1998) Surface Burning Characteristics of Building Materials
ASTM E 119	(1998) Fire Tests of Building Construction and Materials
ASTM E 136	(1996; Rev. A) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 283	(1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	(1997) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E 331	(1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E 546	(1988; R 1995) Frost Point of Sealed Insulating Glass Units
ASTM E 576	(1988; R 1995) Frost Point of Sealed Insulating Glass Units in the Vertical Position
ASTM E 774	(1997) Sealed Insulating Glass Units

AMERICAN WELDING SOCIETY (AWS)

AWS A5.10	(1992) Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods
AWS D1.1	(2000) Structural Welding Code - Steel

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201

Architectural Glazing Materials

PORCELAIN ENAMEL INSTITUTE (PEI)

PEI 1001

(1996) Architectural Porcelain Enamel

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Glazed curtain wall system

Submit for curtain wall system, accessories, and mock-up. Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings will be deferred pending approval of mock-up and accessories. Drawings shall indicate in detail all system parts including elevations, full-size sections, framing, jointing, panels, types and thickness of metal, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.

SD-03 Product Data

Glazed curtain wall system

Include descriptive literature, detailed specifications, and available performance test data.

SD-05 Design Data

Calculations

SD-08 Manufacturer's Instructions

Glazed curtain wall system

Insulating glass

1.3 REQUIREMENT FOR DESIGN DATA

Submit structural and thermal calculations for complete wall assembly.

1.4 QUALITY ASSURANCE

1.4.1 Testing Requirements

The components listed below shall have been tested in accordance with the requirements below, and shall meet performance requirements specified.

- a. Joint and Glazing Sealants: Perform tests as required by applicable publications referenced.

- b. Preformed Compression Gaskets and Seals: ASTM C 864.
- c. Preformed Lock-strip Gaskets: ASTM C 542, modified as follows: Heat age specimens seven days at 158 degrees F, in zipped or locked position under full design compression. Unzip, cool for one hour, re-zip, and test lip seal pressure, which shall be minimum 2.5 pounds per linear inch on any extruded or corner specimen.
- d. Spandrel Glass: Fallout resistance test, ASTM C 1048.
- e. Porcelain Enamel: Acid resistance, color retention, and spall resistance tests, PEI 1001.
- f. Anodized Finishes: Stain resistance, coating weight, and coating thickness tests, ASTM B 136, ASTM B 137, and ASTM B 244, respectively.
- g. Insulating Glass: ASTM E 546 or ASTM E 576 at minus 20 degrees F, no frost or dew point.

1.4.2 Factory Tests

Perform the following tests except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested, under the conditions specified herein, the resulting test reports may be submitted in lieu of testing the components listed below:

- a. Deflection and structural tests.
- b. Water penetration tests.
- c. Air infiltration tests.

1.4.2.1 Deflection and Structural Tests

No curtain wall framing member shall deflect, in a direction normal to the plane of the wall, more than 1/175 of its clear span or 3/4 inch, whichever is less, when tested in accordance with ASTM E 330, except that when a plastered surface will be affected the deflection shall not exceed 1/360 of the span. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E 330 for a minimum test period of 10 seconds at 1.5 times the design wind pressures specified.

1.4.2.2 Water Penetration Test

No water penetration shall occur when the wall is tested in accordance with ASTM E 331 at a differential static test pressure of 20 percent of the inward acting design wind pressure as specified, but not less than 4 psf. Make provision in the wall construction for adequate drainage to the outside of water leakage or condensation that occurs within the outer face of the wall. Leave drainage and weep openings in members and wall open during test.

1.4.2.3 Air Infiltration Test

Air infiltration through the wall, when tested in accordance with ASTM E 283, shall not exceed 0.06 cfm per square foot of fixed wall area, plus the permissible allowance specified for operable windows within the test area.

1.4.2.4 Delamination Test

Adhesively bonded metal-faced panels shall show no evidence of delamination, warpage or other deterioration or damage when subjected to the six "Accelerated Aging Cycles" specified in ASTM D 1037.

1.4.2.5 Thermal Conductance Tests

The thermal transmittance of opaque panels shall not exceed specified U-value, when tested in accordance with ASTM C 236. The average calculated thermal transmittance of the complete wall assembly including panels, windows, and all other components shall not exceed a U-value of .105. Determine U-values of components in accordance with ASTM C 236.

1.4.2.6 Window Tests

Windows shall meet the same requirements for deflection and structural adequacy as specified for framing members when tested in accordance with ASTM E 330 except permanent deformation shall not exceed 0.4 percent; there shall be no glass breakage, and no permanent damage to fasteners, anchors, hardware, or operating devices. Windows shall have no water penetration when tested in accordance with ASTM E 331.

1.4.2.7 Fire Resistance Tests

Insulation provided in the curtain wall system shall have a flame spread rating not exceeding 75 and a smoke developed rating not exceeding 150 when tested in accordance with ASTM E 84, except as specified otherwise herein.

- a. Insulation: Insulation contained entirely within panel assemblies which meets the flame spread and smoke developed ratings of 75 and 150 respectively is not required to comply with the flame spread and smoke developed ratings specified.
- b. Curtain Wall Systems: Material for firestopping the opening between the edge of the floor slab and back of the curtain wall system, shall have not less than the flame spread and smoke developed ratings specified for insulation which is neither isolated from the building interior nor encased in masonry cores.
- c. Curtain Wall Panels: Panels for fire resistive curtain walls shall have a fire resistive rating of 0 hours when tested in accordance with ASTM E 119.
- d. Firestopping Materials and Devices: Firestopping material and attachment devices shall be an effective barrier against the spread of fire, smoke, and gases for a period of 0 hours when exposed to the conditions of the standard ASTM E 119 time-temperature curve for a period equivalent to the fire rating of the floor system and shall also be rated noncombustible when tested in accordance with ASTM E 136.

1.5 GLAZED CURTAIN WALL SYSTEM REQUIREMENTS

Provide system complete with framing, mullions, trim, framed pre-assembled

units, panels, windows, glass, glazing, sealants, insulation, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing the wall to the structure as specified or indicated.

1.5.1 Source

Curtain wall system components shall be furnished by one manufacturer or fabricator; however, all components need not be products of the same manufacturer.

1.5.2 Design

Provide frames and mullions of aluminum or steel. Design frames, mullions, and window hardware to resist a static load of 1 lb per square inch applied to the surface of the glazing. Frame and mullion deformations shall not exceed 1/160 of the unsupported member lengths. The glazing shall have a minimum frame bite of 3/8" for structural glazed window systems and 1" for window systems that are not structurally glazed. Design frame connections to surrounding walls to resist a combined ultimate loading consisting of a tension force of 200 lbs/in and a shear force of 75 lbs/in. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.

1.5.3 Thermal Movement

Fabricate, assemble, and erect system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from 0 degrees F to 130 degrees F.

1.5.4 Tolerances

Design and erect wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified. Provide with the following tolerances:

- a. Maximum variation from plane or location shown on approved shop drawings: 1/8 inch per 12 feet of length up to not more than 1/2 inch in any total length.
- b. Maximum offset from true alignment between two identical members abutting end to end in line: 1/16 inch.

1.5.5 Structural Requirements

No member shall deflect in a direction parallel to the plane of the wall, when carrying its full design load, more than an amount which will reduce the edge cover or glass bite below 75 percent of the design dimension. No member after deflection under full design load, shall have a clearance between itself and the top of the panel, glass, sash, or other part immediately below it less than 1/8 inch; the clearance between the member and an operable window or door shall be minimum 1/16 inch.

1.6 QUALIFICATION OF WELDERS

Welding shall be performed by certified welders qualified in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.

1.7 DELIVERY AND STORAGE

Inspect materials delivered to the site for damage; unload and store with a minimum of handling in accordance with recommendations contained in AAMA CW-10. Storage spaces shall be dry locations with adequate ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Deliver caulking and sealing compounds to the job site in sealed containers labeled to show the designated name, formula or specifications number; lot number; color; date of manufacturer; shelf life; and curing time when applicable.

1.7.1 Protective Covering

Prior to shipment from the factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of aluminum with protective covering of adhesive paper, waterproof tape, or strippable plastic. Covering shall not chip, peel, or flake due to temperature or weather, shall protect against discoloration and surface damage from transportation, and storage, and shall be resistant to alkaline mortar and plaster. Do not cover aluminum surfaces that will be in contact with sealants after installation.

1.7.2 Identification

Prior to delivery, mark wall components to correspond with shop and erection drawings placement location and erection.

1.8 WARRANTY

Insulating glass units shall be guaranteed not to develop material obstruction of vision as a result of dust or film formation on the inner glass surface caused by failure of the seal, other than through glass breakage, within a period of 5 years from date of acceptance of work by the Government. Units failing to comply with the terms of this guarantee shall be replaced with new units without additional cost to the Government. The Contractor shall require the manufacturer to execute their warranties in writing directly to the Government.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum

Shall be free from defects impairing strength or durability of surface finish. Standard alloys shall conform to standards and designations of AA 1. Special alloys, not covered by the following ASTM specifications, shall conform to standards and designations recommended by the manufacturer for the purpose intended.

2.1.1.1 Wrought Aluminum Alloys

Shall be those which include aluminum alloying elements not exceeding the following maximum limits when tested in accordance with ASTM E 34. These

limits apply to both bare products and the core of clad products. The cladding of clad products shall be within the same limits except that the maximum zinc limit may be 2.5 percent in order to assure that the cladding is anodic to the core. Special wrought alloys with a silicon content not more than 7.0 percent will be acceptable for limited structural uses where special appearance is required:

<u>ALLOY</u>	<u>PERCENT</u>
Silicon	1.5
Magnesium, Manganese, and Chromium combined	6.0
Iron	1.0
Copper	0.4
Zinc	1.0

Within the chemical composition limits set forth above, wrought aluminum alloys shall conform to the following:

- a. Extruded bars, rods, shapes and tubes: ASTM B 221.
- b. Sheet and Plate: ASTM B 209.

2.1.1.2 Cast Aluminum Alloys

Provide those in which the alloying elements are silicon, magnesium, manganese, or a combination of these. Other elements shall not exceed the following limits:

<u>ELEMENT</u>	<u>PERCENT</u>
Iron	1.2
Copper	0.4
Nickel	0.4
Titanium	0.2
Others (total)	0.5

Within the chemical composition limits set forth above, cast aluminum alloys shall conform to the following:

- a. Sand castings: ASTM B 26/B 26M.
- b. Die casting: ASTM B 85.
- c. Permanent mold castings: ASTM B 108.

2.1.1.3 Welding Rods and Electrodes

Welding rods and bare electrodes shall conform to AWS A5.10 as recommended by the manufacturer of the aluminum base metal alloy being used.

2.1.1.4 Finish

[AM#2] All exposed surfaces shall be free of unsightly scratches and blemishes. The coating shall be factory applied, oven baked by an approved applicator specifically qualified by the paint manufacturer. No field application. The exposed sections shall receive an alodine pre-treatment followed by a painted coating. The coating shall be a resin based paint conforming with AAMA #2605 and/or #2603 specifications.

2.1.1.5 Strength

Aluminum extrusions for framing members used in curtain walls and main frame and sash or ventilator members in windows shall have a minimum ultimate tensile strength of 22,000 psi and a minimum yield strength of 16,000 psi.

2.1.2 Carbon Steel

Conform to the following specifications:

- a. Rolled shapes, plates, and bars: ASTM A 36/A 36M.
- b. Galvanized sheets: ASTM A 653/A 653M.
- c. Sheets for porcelain enameling: ASTM A 424.
- d. Other sheets: ASTM A 570/A 570M or ASTM A 611.

2.1.3 Stainless Steel

Conform to ASTM A 167, Type 302 or 304, and finish in accordance with the NAAMM AMP 500.

2.1.4 Weathering High-Strength Low-Alloy Steel

Weathering steel shall be a high-strength, low-alloy steel conforming to ASTM A 242/A 242M, ASTM A 588/A 588M, ASTM A 606, and ASTM A 607 as applicable to the shapes and thicknesses required. In addition, the steel shall be capable of developing a tightly adhered protective oxide coating when left unpainted and subjected to atmospheric exposure. Steel shall conform to the manufacturer's published mechanical properties and chemical composition. Perform cleaning, surface preparation, handling, bolting, riveting, and welding of weathering steel in strict accordance with the specification and recommendations of the steel manufacturer.

2.1.5 High-Strength, Low-Alloy Steel

Conform to ASTM A 572/A 572M for structural shapes, plates, and bars.

2.1.6 Metal Fasteners

Provide fasteners as specified in paragraph entitled "Fastener Metals for Joining Various Metal Combinations" in "Part 2 - Products" of the AAMA MCWM-1. Fastener metals used in connection with weathering steel shall be of type recommended by the weathering steel manufacturer. Metals used for fasteners shall be chemically and galvanically compatible with contiguous materials.

2.1.7 Joint Sealants and Accessories

Provide manufacturer's standard colors as closely matching the adjacent surfaces as possible.

2.1.7.1 Elastomeric, Single or Multiple Component

ASTM C 920, Type S, single component and/or Type M, multiple component. Use Grade NS, nonsag type in joints on vertical surfaces and use Grade P, self-leveling or flow type, in joints on horizontal surfaces.

2.1.7.2 Single Component Silicone Rubber Base

ASTM C 920, Type S, Grade NS (Silicone).

2.1.7.3 Solvents and Primers

Provide material which is quick drying, colorless, nonstaining, and compatible with compound used, as recommended by sealant manufacturer. Where primer is specified or recommended by sealant manufacturer, tests related to that material shall include primer.

2.1.7.4 Backing Material

Provide closed cell resilient urethane, polyvinylchloride or polyethylene foam; closed-cell sponge of vinyl or rubber; closed cell neoprene or butyl rod; or polychloroprene tubes or beads. Material shall be non-staining, non-absorbent, and compatible with sealing compound.

2.1.7.5 Bond Preventive Materials

Provide polyethylene tape with pressure-sensitive adhesive; aluminum foil or waxed paper.

2.1.7.6 Preformed Sealing Compound

Provide nonskinning type tapes, beads, ribbons or other shapes as required which conform to AAMA 800.

2.1.8 Glass and Glazing

Materials are specified under Section 08810A, "Glass and Glazing." Conform to ASTM C 1036, except ASTM C 1048 for spandrel glass. All glazing material must be certified as meeting 16 CFR 1201.

2.1.8.1 Glass Sizes and Clearances

Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip to remove flares or to reduce oversized dimensions.

2.1.8.2 Clear Primary Float Glass

Provide Type I, Class I, quality q3, 1/4 inch thick.

2.1.8.3 Insulating Glass

Fused glass, banded, or unbanded. Banded type, ASTM E 774, Class A shall

have perimeter banded or sealed, and encased in a nonferrous metal or stainless steel frame. Unbanded type shall have perimeter sealed by manufacturer's standard organic sealant. Do not field cut.

2.1.1.8.4 Glass Setting Materials

- a. Sealants and preformed sealing compounds shall be as specified under paragraph entitled "Joint Sealant and Accessories."
- b. Preformed compression gaskets and seals: ASTM C 864, color black. Gaskets shall have durable, colorfast coating compatible with adjacent glazing.
- c. Preformed lock-strip type gaskets: ASTM C 542, factory formed, color black. Provide separate filler or locking strips, approximately 10 Shore "A" Durometer points harder than gasket body, and insure permanent and continuous pressure of sealing lips. Grooves and ends shall be square butted or mitered 45 degrees.
- d. Setting blocks, edge blocks, and spacer shims: Fabricate from neoprene or other materials recommended by glass manufacturer compatible with compounds, sealants, or gaskets used. Unless otherwise recommended by the glass manufacturer, shore "A" Durometer hardness for setting and edge blocks shall be 90 plus or minus 5; for spacer shims, 50 plus or minus 5.

2.1.1.9 Firestopping Material

Mineral fiber manufactured from asbestos-free materials, and conforming to ASTM C 612 or ASTM C 665, meeting fire resistance requirements specified.

2.1.1.10 Tempered Hardboard

AHA A135.4, Class 1, 1/2 inch thick.

2.1.1.11 Paint and Finishes

2.1.1.1.1 Primer

Zinc-molybdate, alkyd type.

2.1.1.12 Metal Windows

Fixed. Comply with requirements of AAMA MCWM-1 as modified herein. Provide inside glazing with removable metal glazing beads except for windows having structural gaskets. Comply with glass clearance dimensions and sealant dimensions recommended by glass manufacturer.

2.1.1.2.1 Frames

Frames for fixed glazed panels and window units shall be aluminum.

2.1.1.2.2 Window Construction

Weld or mechanically join and seal corners of frames and ventilators for water-tight construction. Remove excess metal from welded joints and dress smooth on exposed and contact surfaces so that no objectionable discoloration or roughness will be visible after finishing. Apply sealing

compound in interior surfaces of corners and frame intersections.

2.1.13 Metal Accessories

Metal sills, Metal stools, Venetian blind pockets, and Closures,. Fabricate accessories of sizes and shapes indicated from similar materials and finish as specified for wall system. See equipment plans for locations of window units required to be provided with blind pockets and blinds.

PART 3 EXECUTION

3.1 FABRICATION

The curtain wall components shall be of the materials and thickness indicated or specified. The details indicated are representative of the required design and profiles. Acceptable designs may differ from that shown if the proposed system components conform to the limiting dimensions indicated and the requirements specified herein. Unless specifically indicated or specified otherwise, the methods of fabrication and assembly shall be at the discretion of the curtain wall manufacturer. Perform fitting and assembling of components in the shop to the maximum extent practicable. Anchorage devices shall permit adjustment in three directions. Use of exposed fasteners on finished surfaces shall not be permitted.

3.1.1 Joints

Provide welded or mechanical fasteners as indicated or specified. Match joints in exposed work to produce continuity of line and design. Bed-joints or rabbets receiving calking or sealing material shall be minimum 3/4 inch deep and 3/8 inch wide at mid ambient temperature range.

3.1.2 Welding

Conform to AWS D1.1. Use methods and electrodes recommended by manufacturers of base metal alloys. Welding rods shall be of an alloy that matches the color of the metal being welded. Protect glass and other finish from exposure to welding spatter. Ground and finish weld beads on exposed metal surfaces to minimize mismatch and to blend with finish on adjacent parent metal. If flux is used in welding aluminum, completely remove it immediately upon completion of welding operations. Do not use exposed welds on aluminum surfaces.

3.1.3 Soldering and Brazing

Provide as recommended by suppliers. Solder only for filling or sealing joints.

3.1.4 Ventilation and Drainage

Provide internal ventilation drainage system of weeps based on principles of pressure equalization to ventilate the wall internally and to discharge condensation and water leakage to exterior as inconspicuously as possible. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.

3.1.5 Protection and Treatment of Metals

3.1.5.1 General

Remove from metal surfaces lubricants used in fabrication and clean off all other extraneous material before leaving the shop.

3.1.5.2 Galvanic Action

Provide protection against galvanic action wherever dissimilar metals are in contact, except in the case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint or apply appropriate calking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

3.1.5.3 Protection for Aluminum

Protect aluminum which is placed in contact with, built into, or which will receive drainage from masonry, lime mortar, concrete, or plaster with one coat of alkali-resistant bituminous paint. Where aluminum is contacted by absorptive materials subject to repeated wetting or treated with preservative noncompatible with aluminum, apply two coats of aluminum paint to such materials and seal joints with approved calking compound.

3.2 INSTALLATION

Installation and erection of glazed wall system and all components shall be performed under direct supervision of and in accordance with approved recommendations and instructions of wall system manufacturer or fabricator.

3.2.1 Bench Marks and Reference Points

Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of the marks, stop erection work in that area until discrepancies have been corrected.

3.2.2 Verifying Conditions and Adjacent Surfaces

After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other possible dimensional tolerances in the building frame which could affect the installation of the system.

3.2.3 Panels

Install panels into framed pre-assembled units with gaskets and sealants as indicated or specified.

3.2.4 Windows

Install windows in accordance with details indicated and approved shop drawings.

3.2.4.1 Sealing

Seal exterior metal to metal joints between members of windows, frames, mullions, and mullion covers. Remove excess sealant.

3.2.5 Joint Sealants

3.2.5.1 Surface Preparation

Surfaces to be primed and sealed shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on all sides. Clean out grooves to proper depth. Joint dimensions shall conform to approved shop drawings with a tolerance of plus 1/8 inch. Do not apply compound unless ambient temperature is between 40 and 90 degrees F. Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings shall be of type that leave no residue on exposed surfaces.

3.2.5.2 Applications

Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 5 gallons.

3.2.5.3 Primer

Apply to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after calking is completed.

3.2.5.4 Backing

Tightly pack in bottom of joints which are over 1/2 inch in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.

3.2.5.5 Bond Prevention

Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering the full width and length of joint cavities.

3.2.5.6 Protection and Cleaning

Remove compound smears from surfaces of materials adjacent to sealed joints as the work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of calking and sealing, remove remaining smears, stains, and other soiling, and leave the work in clean neat condition.

3.2.6 Glass

Install in accordance with manufacturer's recommendations as modified herein. Install insulating glass units made with heat absorbing glass with heat absorbing pane on exterior side.

3.2.6.1 Inspection of Sash and Frames

Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.

3.2.6.2 Preparation of Glass and Rabbets

Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer.

3.2.6.3 Positioning Glass

Set glass from inside the building unless otherwise indicated or specified. Maintain specified edge clearances and glass bite at perimeter. Maintain position of glass in rabbet and provide required sealant thickness on both sides of glass. For glass dimensions larger than 50 inches, provide setting blocks at sill and spacer shims on all four sides. Locate setting blocks one quarter way in from each jamb edge of glass. Where setting blocks and spacer shims are set into glazing compound or sealant, butter with compound or sealant, place in position, and allow to firmly set prior to installation of glass.

3.2.6.4 Setting Methods

Apply glazing compound, glazing sealant, glazing tape, and gaskets uniformly with accurately formed corners and bevels. Remove excess compound from glass and sash. Use only recommended thinners, cleaners, and solvents. Strip surplus compound from both sides of glass and tool at slight angle to shed water and provide clean sight lines. Secure stop beads in place with suitable fastenings. Do not apply compound or sealant at temperatures lower than 40 degrees F, or on damp, dirty, or dusty surfaces. After glazing, fix ventilators in sash so they cannot be operated until compound or sealant has set. Use compression gasket glazing, with compression gaskets at locations as recommended by curtain wall manufacturer to meet the requirements of this section.

3.2.6.5 Void Space

For heat absorbing, insulating, spandrel, tempered glass, and glass of other types that exceed 100 inches in size provide void space at head and jamb to allow glass to expand or move without exuding the sealant.

3.2.6.6 Insulating Glass

Provide adequate means to weep incidental water and condensation away from the sealed edges of insulated glass units and out of the wall system. The weeping of lock-strip gaskets should be in accordance with the recommendation of the glass manufacturer.

3.2.6.7 Insulating Glass With Edge Bands

For insulating glass with flared metal edge bands set in lock-strip type gaskets, follow glass manufacturer's installation recommendations and add supplementary wet seal as required. When glazing tape is utilized, use tapered tape.

3.2.7 Firestopping

Provide firestopping in openings between wall system and floor at each story to prevent passage of flame and hot gases from floor to floor under extended fire exposure. Installed fire stopping shall remain in place under extended fire exposure despite distortions that may occur in wall system components. Securely attach anchoring or containment devices to building structure and not to wall system. Place mineral fiber impaling clips embedded in edge of floor slab.

3.3 FINISHES

3.3.1 Galvanizing

Conform to ASTM A 123/A 123M, ASTM A 153/A 153M, and ASTM A 653/A 653M, as applicable.

3.3.1.1 Repair of Zinc-Coated Surfaces

Repair zinc coated surfaces damaged by welding or other means with galvanizing repair paint or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved.

3.3.2 Shop Cleaning and Painting

3.3.2.1 Cleaning

Clean steel and iron work by power wire brushing or other approved manual or mechanical means, for removal of rust, loose paint, scale, and deleterious substances. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other foreign matter, with solvents until thoroughly clean. Cleaning steel embedded in concrete is not required.

3.3.2.2 Painting Steel or Iron Surfaces

Apply primer to a minimum dry film thickness of 1.0 mil. Apply additional shop coat of specified paint, to which a small amount of tinting material has been added, on surfaces that will be concealed in the finished construction or that will not be accessible for finish painting. Accomplish painting in dry weather or under cover, and on steel or iron surfaces that are free from moisture and frost. Do not paint surfaces of items to be embedded in concrete. Recoat damaged surfaces upon completion of work. Prime coat steel immediately after cleaning. Do not apply bituminous protective coatings to items to be finish painted.

3.3.2.3 Painting Weathering Steel

Clean and paint surfaces which will not be exposed to the weather with one shop or field coat of specified primer, or other approved rust-inhibitive primer. Clean and strip-paint weathering steel contact surface to be covered by structural or compression gaskets or sealants with one coat to insure positive seal.

3.4 FIELD TESTS

Conduct field check test for water leakage on designated wall areas after erection. Conduct test on two wall areas, two bays wide by two stories high where directed. Conduct test and take necessary remedial action as described in AAMA 501.

3.5 CLEANING AND PROTECTION

3.5.1 Glass

Upon completion of wall system installation, thoroughly wash glass surfaces on both sides and remove labels, paint spots, putty, compounds, and other defacements. Replace cracked, broken, and defective glass with new glass at no additional cost to the Government.

3.5.2 Aluminum Surfaces

Protection methods, cleaning, and maintenance shall be in accordance with AAMA 609 and AAMA 610.1.

3.5.3 Other Metal Surfaces

After installation, protect windows, panels, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of the respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. Wash wall system with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or the respective trade association.

-- End of Section --

SECTION 09000

BUILDING COLOR AND FINISH SCHEDULE

08/2002

AMENDMENT #0002

PART 1 GENERAL

1.1 SUMMARY

This section covers colors, patterns, and textures of exterior and interior floor, wall, ceiling, and equipment finish materials.

1.2 REFERENCES TO MANUFACTURERS AND PRODUCTS

The manufacturer's names and their products referenced in this section only indicate the color, texture, and pattern required for the materials listed. The products furnished shall meet the color, texture, and pattern indicated as well as the material quality and performance specified in the applicable technical sections. The use of manufacturer's names and products do not preclude the use of other manufacturer's products of approved equal color, texture, or pattern as long as all requirements are met.

1.3 ABBREVIATIONS: MANUFACTURERS AND MATERIALS

<u>Abbreviation</u>	<u>Material</u>	<u>Manufacturer</u>	<u>Mfgr's No/Color</u>
ATC-1	Acoustical Ceiling	Armstrong	1821 - Fine Fissured
AEIFS-1 Medium	Insulation & Finish Sys.	Sto	93330 / Champagne 306
CONC	Exposed Concrete w/ clear sealer		
CPT-1	Carpet	Interface	Suji / 2298 Willow
CPT-2	Carpet	Interface	Paint Box / 3550 Patina
CT-1	Ceramic Tile	DalTile	VS04 / Almond
CT-2	Ceramic Tile	DalTile	DC01 / Biscuit
CT-3	Ceramic Tile	DalTile	VS10 / Cotto
CT-4	Ceramic Tile	DalTile	VS14 / Green Granite
FAF-1	Fluid Applied Flooring	Themec	68BR Twine
FP-1	Folding Partition	Modernfold	
GRT-1	Grout	Laticrete	18 / Sauterne
Mini Blinds		Levelor	White

PT-1	Paint	Sherwin Williams	1151 / Doric White
PT-2	Clear sealer		
PT-3	Paint	Sherwin Williams	1151 / Doric White
PT-4	Paint	Sherwin Williams	1113 / Raffia Basket
PT-5	Paint	Tnemec Series 201 Primer Tnemec Series 280 Glaze /16BR Orion's	
Belt			
PL-1	Plastic Laminate	Nevamar	EM-6-1T / Aged Elements
PL-2	Plastic Laminate	Pionite	AT101-S / Suede
Oatmeal Fiber			
RB-1	Resilient Base	Burke	701 - Black
SS-1	Solid Surfacing	Fountainhead	FT-2-10 / Treasure
Artifacts			
SS-2	Solid Surfacing	Fountainhead	FM-2-3 / Wheat Matrix
SSF-1	Sheet Flooring	Marmoleum	3077 - Tan Pink
SSF-2	Sheet Flooring	Marmoleum	3139 - Lava
SSF-3	Sheet Flooring	Marmoleum	3164 - Indian Summer

1.4 EXTERIOR COLOR/FINISH INSTRUCTIONS

1.4.1 Bollard Guards

Bollard Guards shall be painted 2" Black Spiral with 2" space between stripes on yellow background.

1.4.2 Brick

Brick shall match TBD.

1.4.3 Fieldstone Pavers

Fieldstone pavers shall be locally quarried, in a color to match brick.

1.4.4 Fieldstone Paver Grout

Fieldstone paver grout shall be in a color to match fieldstone.

1.4.5 Doors and Frames

Aluminum: Shall match [AM#2] structural standing seam roof panels (Evergreen #435B137).

Steel: Shall match composite foam insulated metal roof panels (Evergreen #435B137).

1.4.6 Glazing

Glazing is specified in Section 08810 GLASS AND GLAZING.

1.4.7 Handrails

Handrails shall be painted to match composite foam insulated metal roof panels (Evergreen #435B137).

1.4.8 Metal Roofing and Siding

Color finish of [AM#2] structural standing seam metal roof panels shall match Valspar Fluropon Evergreen #435B137. Color finish of composite foam insulated metal wall and soffit panels shall match Valspar Fluropon paint in color to match building exterior insulation and finish system (EIFS).

1.4.9 Sheet Metalwork

1.4.9.1 Coping

Color finish to match [AM#2] structural standing seam metal roof.

1.4.9.2 Vertical Composite Foam Insulated Metal Fascia and Soffit Panels

Color finish to match composite foam insulated metal roof panels (Evergreen #435B137).

1.4.9.3 Gutters and Downspouts

Color finish to match [AM#2] structural standing seam metal roof.

1.4.9.4 Louvers

Louvers shall match exterior insulation and finish system.

1.4.10 EIFS

EIFS shall have integral color - STO, 93330 Champagne.

1.4.11 Windows[AM#2], Glazed Curtain Wall, Aluminum Doors & Frames

Aluminum: Shall match [AM#2] structural standing seam metal roofing panels (Evergreen #435B137).

1.4.12 Windows Subsills

Aluminum windows subsills shall match exterior insulation and finish system.

1.5 INTERIOR COLOR/FINISH INSTRUCTIONS

1.5.1 Cabinets

Cabinets shall be a PL-1 finish.

1.5.2 Ceramic Tile Grout

In men's and women's toilets, shower and locker areas, a grout to match GRT-1.

1.5.3 Doors and Frames

1.5.3.1 Shall be painted in color to match [AM#2] structural standing seam metal roof panels (Evergreen #435B137)..

1.5.4 Door Hardware

Door hardware finish is specified in Section 08700 BUILDERS' HARDWARE.

1.5.5 Folding Partitions

Shall match adjacent wall finishes.

1.5.6 Handrails

Handrails shall be painted to match composite foam insulated metal roof panels (Evergreen #435B137).

1.5.7 HVAC Equipment

Shall be painted to match exterior insulation and finish system.

1.5.7.1 Grills or Diffusers

Paint all supply and return air mechanical grills or diffusers on gypsum board ceiling and walls to match adjacent color.

1.5.8 Lockers

Lockers shall match PT-4.

1.5.9 Mini Blinds

Shall match aluminum storefront system (Evergreen #435B137).

1.5.10 Plastic Laminate

1.5.10.1 Counters

As Indicated on the drawings.

1.5.11 Shelving

Interior shelving shall match adjacent wall.

1.5.12 Suspended Ceiling Grid

Suspended Ceiling Grid shall match ceiling tiles in manufacturer's standard finish and shall be a narrow 9/16-inch grid to match Armstrong exposed tee system.

1.5.13 Toilet Partitions

Toilet Partitions shall match PT-4.

1.5.14 Walls

All interior walls of gypsum board and underside of stairs shall be painted to match PT-3, unless otherwise indicated.

1.5.15 Window Frames (Interior, Glazing)

Steel, Painted to match composite foam insulated metal roof panels
(Evergreen #435B137).

1.6 ROOM COLOR AND FINISH SCHEDULE

As indicated on Finish Schedules on sheets AA603 (Deployment Building),
AB601 (Pallet Warehouse Building), and AC601 (Base Operations Building).

PART 2 PRODUCTS (NOT USED)

PART 3 NOT USED

-- End of Section --

SECTION 10153

TOILET PARTITIONS

07/98

AMENDMENT #0002

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

Toilet partition system, including toilet enclosures, room entrance screens, and urinal screens, shall be a complete and usable system of panels, hardware, and support components. The partition system shall be provided by a single manufacturer, and shall be a standard product as shown in the most recent catalog data. The partition system shall be as shown.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Toilet Partition System;

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

SD-04 Drawings

Toilet Partition System;

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchorings.

SD-14 Samples

Toilet Partition System; G.

Manufacturer's standard color charts and color samples.

1.3 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated; free from dust, water, or other contaminants; and shall have easy access for inspection and handling.

1.4 WARRANTY

Manufacturer's standard performance guarantee or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to CID A-A-60003, Type I, Style A, floor supported. Width, length, and height of toilet enclosures shall be as shown. Finish surface of panels shall be [AM#2] high density polyethylene (HDPE) with homogenous color throughout, not less than 1 inch thick with seamless construction and eased edges. Panels indicated to receive toilet paper holders or grab bars as specified in Section 10800 TOILET ACCESSORIES, shall be prepared for mounting of the items required. Grab bars shall withstand a bending stress, shear stress, shear force, and a tensile force induced by 1112 N. Grab bars shall not rotate within their fittings.

2.2 URINAL SCREENS

Urinal screens shall conform to CID A-A-60003, Type III, Style A, floor supported. Finish surface of panels shall be [AM#2] high density polyethylene (HDPE) with homogenous color throughout, not less than 1 inch thick with seamless construction and eased edges. Width and height of urinal screens shall be as shown.

2.3 HARDWARE

Hardware for the toilet partition system shall conform to CID A-A-60003 for the specified type and style of partitions. Hardware finish shall be highly resistant to alkalies, urine, and other common toilet room acids.

2.4 COLORS

Color of finishes for toilet partition system components shall be manufacturer's standard as specified in Section 09000 BUILDING COLOR AND FINISH SCHEDULE[AM#2] , for solid surfacing.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by through-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work.

3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 1/4 inch and shall rest open at approximately 30 degrees when unlatched. [AM#2] Replace damage work as directed and per manufacturer's recommendation. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage until accepted.

-- End of Section --

SECTION 10450

WAIST-HIGH OPTICAL TURNSTILES

07/03

AMENDMENT #0002

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

The optical turnstile system shall provide barrier free access control. The units shall be designed to work with various access control/ID systems, and provide single or bi-directional control by detecting movement through the turnstile and sounding a local or remote alarm when unauthorized entry occurs.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings; G

Submit shop drawings of all components, fittings, parts, wiring, and installation procedures showing layout, jointing, and complete anchoring and supporting systems for the various applications, and mounting details. Drawings shall clearly show provisions for all performance functions described herein.

SD-03 Product Data; G

Manufacturer's Data

Submit six copies of the manufacturer's technical data and installation instructions for each type of sign required.

Warranty; G,

Two copies of the warranty.

System Components; G

Complete listing of part/model numbers for all components to be furnished, including names and codes of components referenced on updated drawings.

SD-07 Certificates

Submit certificates indicating that all materials and products used on the Project meet or exceed specified requirements.

SD-10 Operation and Maintenance Data

Product Assembly Manual; G

Six sets of assembly manuals describing assembly and reconfiguration procedures.

Product Maintenance Manuals; G
Cleaning;

Six sets of maintenance manuals describing proper cleaning and minor repair procedures.

1.3 DELIVERY, STORAGE, AND HANDLING

Materials shall be stored in original protective packaging in a safe, dry, and clean location and shall be handled in a manner to prevent damage.

PART 2 PRODUCTS

2.1 DESCRIPTION

The waist high optical sensor monitored, barrier free passage optical turnstile utilizes infrared sensors and/or access control contacts to provide bidirectional controlled access. The sensors determine the direction of pedestrian travel and register a count output signal as either an entry or exit. The unit shall utilize multiple transmit / receive infrared sensors mounted inside the turnstile cabinets to detect passage and LED light boards consisting of red, yellow, and green LED arrays to indicate turnstile status and, whether access has been granted or denied. The turnstiles shall be equipped to accept various reader technologies; i.e. proximity, weigand, mag stripe, bar code, or biometrics to monitor pedestrian flow. Data output shall provide realtime and historical information on all entrance and exit activity.

2.2 MATERIALS AND FABRICATION

2.2.1 Enclosures

The cabinet body will be constructed of formed and welded 16 ga., type 304 stainless steel with a polished to a #4 brushed satin finish. All exterior welds will be ground smooth and polished and there are no exterior fasteners visible on the cabinet. The top cover will be a matching metal. The side panels will be removable to allow access to the lights, electrical and network connections.

2.2.2 Frame

The internal frame will be constructed of 3/8" steel. Pre-drilled mounting holes and access for electrical and wiring will be provided. A minimum 36" baseplate will be provided.

2.2.3 Sensors and Counters

Infrared and reader sensors will be recessed mounted near the center of the cabinet. Battery powered counters will be recessed on the approach side vertical face or on the top of the cabinet and provide an LCD readout.

2.3 TECHNICAL DATA

2.3.1 Power and Requirements

110VAC, GFI protected. internal components are low voltage.

#.1 Network Requirements

Communications cabling will run from each turnstile to network connection for optional PC based controller.

2.4 WARRANTY

A two-year warranty will apply to all parts.

PART 3 EXECUTION

3.1 INSTALLATION

The turnstiles shall be installed in accordance with the manufacturer's instructions and with the approved detail drawings. All turnstiles must be installed on a firm foundation in a manner that allows the required power and activation signal cabling to be pulled into the turnstile cabinets. The cabinets must be installed on level concrete. No embedded fasteners are needed for installation. Installation should be performed by a skilled installer following the manufacturer's directions and instructions (supplied with the unit).

3.1.1 Preparation for Installation

The area in which the floor system is to be installed shall be cleared of all debris. Structural floor surfaces shall be thoroughly cleaned and all dust shall be removed. Floor coatings required for dust or vapor control shall be installed prior to installation of pedestals only if the pedestal adhesive will not damage the coating. If the coating and adhesive are not compatible, the coating shall be applied after the pedestals have been installed and the adhesive has cured.

3.1.2 Turnstiles

Turnstiles shall be accurately spaced, and shall be set plumb and in true alignment. Base plates shall be in full and firm contact with the structural floor, and shall be secured to the structural floor in accordance with manufacturer's instructions.

3.2 SHIPPING

Cabinets are shipped fully assembled and ready for installation. Each cabinet includes mounting hardware (anchor bolts, washers, etc.) to mount unit to floor.

3.3 ACCEPTANCE TESTING

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. The tests shall verify that ALL deficiencies have been corrected. The test shall include the following:

- a. Test of each function of the control panel.

Complete operational tests.

- c. Visual inspection of wiring connections.
- d. Test of each communications connection.

3.4 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for systems operation shall consist of 1 training day (8 hours) and shall start after the system is functionally completed but prior to final acceptance tests. The training period for systems maintenance shall consist of 8 hours and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions.

3.5 CLEANING AND PROTECTION

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Turnstile surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

-- End of Section --

SECTION 11145A

[AM#2] DELETED

SECTION 13280A

ASBESTOS ABATEMENT

11/01

AMENDMENT #0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|------------|-----------------------------------------------------------------------------------------|
| ANSI Z87.1 | (1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection |
| ANSI Z88.2 | (1992) Respiratory Protection |
| ANSI Z9.2 | (1979; R 1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|--------------------------------------------------------------------------------------------|
| ASTM C 732 | (1995) Aging Effects of Artificial Weathering on Latex Sealants |
| ASTM D 1331 | (1989; R 1995) Surface and Interfacial Tension of Solutions of Surface-Active Agents |
| ASTM D 2794 | (1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) |
| ASTM D 4397 | (1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications |
| ASTM D 522 | (1993a) Mandrel Bend Test of Attached Organic Coatings |
| ASTM E 119 | (1998) Fire Tests of Building Construction and Materials |
| ASTM E 1368 | (1997) Visual Inspection of Asbestos Abatement Projects |
| ASTM E 736 | (1992) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members |
| ASTM E 84 | (1998 e1) Surface Burning Characteristics of Building Materials |

ASTM E 96 (1995) Water Vapor Transmission of Materials

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7 (1990) Compressed Air for Human Respiration

CGA G-7.1 (1997) Commodity Specification for Air

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (1999; TIA 96-1, 96-2) Methods of Fire Tests for Flame-Resistant Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 84-100 (1984; Supple 1985, 1987, 1988 & 1990) NIOSH Manual of Analytical Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90/018 (1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance

EPA 560/5-85-024 (1985) Guidance for Controlling Asbestos-Containing Materials in Buildings

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926 Safety and Health Regulations for Construction

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

40 CFR 763 Asbestos

42 CFR 84 Approval of Respiratory Protective Devices

49 CFR 107 Hazardous Materials Program Procedures

49 CFR 171 General Information, Regulations, and Definitions

49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173

Shippers - General Requirements for
Shipments and Packagings

UNDERWRITERS LABORATORIES (UL)

UL 586

(1996) High-Efficiency, Particulate, Air
Filter Units

TEXAS DEPARTMENT OF HEALTH (TDH)

1.2 DEFINITIONS

- a. Adequately Wet: A term defined in 40 CFR 61, Subpart M, and EPA 340/1-90-019 meaning to sufficiently mix or penetrate with liquid to prevent the release of particulate. If visible emissions are observed coming from asbestos-containing material (ACM), then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.
- b. Aggressive Method: Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact asbestos-containing material (ACM).
- c. Amended Water: Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with ASTM D 1331.
- d. Asbestos: Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.
- e. Asbestos-Containing Material (ACM): Any materials containing more than one percent asbestos.
- f. Asbestos Fiber: A particulate form of asbestos, 5 micrometers or longer, with a length-to-width ratio of at least 3 to 1.
- g. Authorized Person: Any person authorized by the Contractor and required by work duties to be present in the regulated areas.
- h. Building Inspector: Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.
- i. Certified Industrial Hygienist (CIH): An Industrial Hygienist certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.
- j. Class I Asbestos Work: Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM. This activity is not applicable to this project.

- k. Class II Asbestos Work: Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos - containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.
- l. Clean room: An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.
- m. Competent Person: In addition to the definition in 29 CFR 1926, Section .32(f), a person who is capable of identifying existing asbestos hazards as defined in 29 CFR 1926, Section .1101, selecting the appropriate control strategy, has the authority to take prompt corrective measures to eliminate them and has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.
- n. Contractor/Supervisor: Individual who supervises asbestos abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; accreditation required by 40 CFR 763, Subpart E, Appendix C.
- o. Critical Barrier: One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.
- p. Decontamination Area: An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.
- q. Demolition: The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.
- r. Disposal Bag: A 6mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926, Section .1101, used for transporting asbestos waste from containment to disposal site.
- s. Disturbance: Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in 1 standard sized glovebag or waste bag, not larger than 60 inches in length and width in order to access a building component.
- t. Equipment Room or Area: An area adjacent to the regulated area used for the decontamination of employees and their equipment.
- u. Employee Exposure: That exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.

- v. Fiber: A fibrous particulate, 5 micrometers or longer, with a length to width ratio of at least 3 to 1.
- w. Friable ACM: A term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Subpart E, Appendix A, Section 1, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent, as determined by a method other than point counting by PLM, the asbestos content is verified by point counting using PLM.
- x. Glovebag: Not more than a 60 by 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.
- y. High-Efficiency Particulate Air (HEPA) Filter: A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.
- z. Homogeneous Area: An area of surfacing material or thermal system insulation that is uniform in color and texture.
- aa. Industrial Hygienist: A professional qualified by education, training, and experience to anticipate, recognize, evaluate, and develop controls for occupational health hazards.
- bb. Intact: ACM which has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix. Removal of "intact" asphaltic, resinous, cementitious products does not render the ACM non-intact simply by being separated into smaller pieces.
- cc. Model Accreditation Plan (MAP): USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763, Subpart E, Appendix C.
- dd. Modification: A changed or altered procedure, material or component of a control system, which replaces a procedure, material or component of a required system.
- ee. Negative Exposure Assessment: A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).
- ff. NESHAP: National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61, Subpart M.
- gg. Nonfriable ACM: A NESHAP term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material containing more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Subpart E, Appendix A, Section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

- hh. Nonfriable ACM (Category I): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in 40 CFR 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.
- ii. Nonfriable ACM (Category II): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos, as determined using the methods specified in 40 CFR 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- jj. Permissible Exposure Limits (PELs):
 - (1) PEL-Time weighted average(TWA): Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8 hour time weighted average (TWA), as determined by the method prescribed in 29 CFR 1926, Section .1101, Appendix A, or the current version of NIOSH Pub No. 84-100 analytical method 7400.
 - (2) PEL-Excursion Limit: An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes as determined by the method prescribed in 29 CFR 1926, Section .1101, Appendix A, or the current version of NIOSH Pub No. 84-100 analytical method 7400.
- kk. Regulated Area: An OSHA term defined in 29 CFR 1926, Section .1101 meaning an area established by the Contractor to demarcate areas where Class I, II.
- ll. Removal: All operations where ACM is taken out or stripped from structures or substrates, and includes demolition operations.
- mm. Repair: Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM attached to structures or substrates. If the amount of asbestos so "disturbed" cannot be contained in 1 standard glovebag or waste bag, Class I precautions are required.
- nn. Spills/Emergency Cleanups: Cleanup of sizable amounts of asbestos waste and debris which has occurred, for example, when water damage occurs in a building, and sizable amounts of ACM are dislodged. A Competent Person evaluates the site and ACM to be handled, and based on the type, condition and extent of the dislodged material, classifies the cleanup as Class I or II.
- oo. Surfacing ACM: Asbestos-containing material which contains more than 1% asbestos and is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.
- pp. Thermal system insulation (TSI) ACM: ACM which contains more than 1% asbestos and is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components

to prevent heat loss or gain or water condensation.

qq. Transite: A generic name for asbestos cement wallboard and pipe.

rr. Worker: Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926, Section .1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation required by 40 CFR 763, Subpart E, Appendix C, if required by the OSHA Class of work to be performed or by the state where the work is to be performed.

1.3 DESCRIPTION OF WORK

Work in this section for the project Fixed Wing Aircraft Park [AM#1] Phase II at Fort Hood, Texas includes asbestos-containing material (ACM) abatement [AM#1] as part of the Bid [AM#1] [AM#1] in B/90050 Fire Station and [AM#1] B/90049 Control Tower & Ops Bldg [AM#1] prior to demolition of the buildings, and [AM#2] abatement of ACM [AM#2] in B/90079 Air Lift Terminal [AM#1], B/90080 Parachute Rigging Facility, [AM#2] as noted on Demolition Drawings and attached Asbestos Survey and Analysis Report.

[AM#2] _____

Asbestos abatement involves OSHA Class I and Class II work shall be performed for Bid Options No. 1 and No. 2. Approximately asbestos quantities are identified on the project environmental drawings for the bid options. However, abatement of the ACM floor tiles, tile mastic and roof penetration mastic is not required in [AM#2] B/90049 and B/90050 [AM#2] if material is evaluated with the COR and determined to be in good condition. The non-friable ACM is in good condition and it shall be demolished in-place with B/90050, the total demolition debris shall be disposed of at the Fort Hood Landfill. The Contractor shall adequately wet the ACM debris. During demolition the ACM shall not be subjected to sanding, grinding, cutting, or abrading per EPA 340/1-90-018 and EPA 340/1-90-019.

The abated ACM debris [AM#2] and building demolition debris containing ACM shall be disposed [AM#2] in Ft Hood sanitary landfill in accordance with Section 01368 Special Project Procedures for Fort Hood.

Asbestos survey was performed in March 1999 (for B/90079, B/90080, and 90071), in November 1999 (for B/90050), and in January 2000 (for B/90049). A summary of work task data elements for each individual ACM abatement work task is included in Table 1, "Individual Work Task Data Elements" at the end of this section. The Contractor shall verify abatement items and conditions prior to start work.

This section describes procedures and equipment required to protect workers and environment from airborne asbestos fibers, ACM dust and debris. This section asbestos abatement activity involves OSHA Class I and Class II work operation. The Contractor shall provide containment, storage, transportation and disposal of the generated ACM wastes. The Contractor shall provide specific operational procedures in the Accident Prevention Plan and its sub components, the Asbestos Hazard Abatement Plan and Activity Hazard Analyses required in paragraph, SAFETY AND HEALTH PROGRAM AND PLANS.

1.3.1 Abatement Work Tasks

A summary of work task data elements for each individual ACM abatement work task is in Table 1, "Individual Work Task Data Elements" at the end of this section.

1.3.2 Unexpected Discovery of Asbestos

For any previously untested building components suspected to contain asbestos and located in areas impacted by the work, the Contractor shall notify the Contracting Officer (CO) who will have the option of ordering up to six (6) bulk samples to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM at no additional cost to the Government. Any additional components identified as ACM that have been approved by the Contracting Officer for removal shall be removed by the Contractor and will be paid for by an equitable adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling activities undertaken to determine the presence of additional ACM shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course required by 40 CFR 763, Subpart E, Appendix C.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Materials and Equipment; FIO.

Manufacturer's catalog data for all materials and equipment to be used in the work, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of this specification. Material Safety Data Sheets for all chemicals to be used onsite in the same format as implemented in the Contractor's HAZARD COMMUNICATION PROGRAM. Data shall include, but shall not be limited to, the following items:

- a. High Efficiency Filtered Air (HEPA) local exhaust equipment
- b. Vacuum cleaning equipment
- c. Pressure differential monitor for HEPA local exhaust equipment
- d. Air monitoring equipment
- e. Respirators
- f. Personal protective clothing and equipment

- (1) Coveralls

- (2) Underclothing
- (3) Other work clothing
- (4) Foot coverings
- (5) Hard hats
- (6) Eye protection
- (7) Other items required and approved by Contractors Designated IH and Competent Person

g. Glovebag

h. Duct Tape

i. Disposal Containers

- (1) Disposal bags
- (2) Fiberboard drums
- (3) Paperboard boxes

j. Sheet Plastic

- (1) Polyethylene Sheet - General
- (2) Polyethylene Sheet - Flame Resistant
- (3) Polyethylene Sheet - Reinforced

k. Wetting Agent

- (1) Amended Water
- (2) Removal encapsulant

l. Strippable Coating

m. Prefabricated Decontamination Unit

n. Other items

o. Chemical encapsulant

p. Chemical encasement materials

q. Material Safety Data Sheets (for all chemicals proposed)

SD-04 Drawings

Site Layout; GA.

Descriptions, detail project drawings, and site layout for each building to include worksite containment area techniques, local exhaust ventilation system locations, decontamination units and load-out units, other temporary waste storage facility, access tunnels, location of temporary utilities (electrical, water, sewer) and boundaries of each regulated area. Site Layout shall be submitted with the Contractor's Asbestos Hazard Abatement Plan.

SD-08 Statements

Qualifications; GA.

A written report providing evidence of qualifications for personnel, facilities and equipment assigned to the work.

Training Program; FIO.

A copy of the written project site-specific training material as indicated in 29 CFR 1926, Section .1101 that will be used to train onsite employees. The training document shall be signed by the Contractor's Designated Industrial Hygienist (IH) and Competent Person.

Medical Requirements; FIO.

Physician's written opinion.

Encapsulants; GA

Certificates stating that encapsulants meet the applicable specified performance requirements per paragraph ENCAPSULANTS.

SD-09 Reports

Exposure Assessment and Air Monitoring; GA

Initial exposure assessments, negative exposure assessments, air-monitoring results and documentation per paragraph EXPOSURE ASSESSMENT AND AIR MONITORING.

Local Exhaust Ventilation; FIO.

Pressure differential recordings.

Licenses, Permits and Notifications; GA

Licenses, permits, and notifications submittal per paragraph LICENSES, PERMIT AND NOTIFICATIONS. In addition, prior to start work, Contractor shall submit current medical certificate, training certificate and state license of each worker, including air monitoring technician.

SD-13 Certificates

Vacuum, Filtration and Ventilation Equipment, FIO.

Manufacturer's certifications showing compliance with ANSI Z9.2 for:

- a. Vacuums.
- b. Water filtration equipment.
- c. Ventilation equipment.
- d. Other equipment required to contain airborne asbestos fibers.

SD-18 Records

Respiratory Protection Program; GA.

Records of the respirator program per paragraph RESPIRATORY PROTECTION PROGRAM.

Safety and Health Program and Plans; GA.

Preparation of Accident Prevention Plan, Asbestos Hazard Abatement Plan, and Activity Hazard Analyses per paragraph SAFETY AND HEALTH PROGRAM AND PLANS. Two copies of the Asbestos Hazard Abatement Plan shall be required. One copy shall be submitted to the Contracting Officer Representative (COR) and the other copy shall be submitted to Ms. Rosemarie Olney, Industrial Hygienist at Fort Hood DPW-ENV, 20 working days prior to the pre-construction meeting.

Cleanup and Disposal; GA.

A copy of waste shipment records, weigh bills, delivery tickets, daily narrative log of work, descriptions of problems and resolutions, exposure assessment and analytical results shall be provided with the Closure Report. The Closure Report shall be furnished to the COR in at least 10 working days after completion of work in this section, and prior to final payment.

1.5 QUALIFICATIONS

1.5.1 Written Qualifications and Organization Report

The Contractor shall furnish a written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Designated IH (person assigned to project and firm name); independent testing laboratory (including name of firm, principal, and analysts who will perform analyses); all subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. The report shall include an organization chart showing the Contractor's staff organization for this project by name and title, chain of command and reporting relationship with all subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all subcontractors to be used. The Contractor shall include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926, Section .1101, 40 CFR 61, Subpart M, and the federal, state and local requirements specified in paragraph SAFETY AND HEALTH PROGRAM AND PLANS for those asbestos abatement activities that they will be involved in."

1.5.2 Specific Requirements

The Contractor shall designate in writing, personnel meeting the following qualifications:

- a. Designated Competent Person: The name, address, telephone number, and resume of the Contractor's Designated Competent Person shall be provided. Evidence that the full-time Designated Competent Person is qualified in accordance with 29 CFR 1926, Sections .32 and .1101, has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C, and is experienced in the

administration and supervision of asbestos abatement projects, including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite, etc. The duties of the Competent Person shall include the following: controlling entry to and exit from the regulated area; supervising any employee exposure monitoring required by 29 CFR 1926, Section .1101; ensuring that all employees working within a regulated area wear the appropriate personal protective equipment (PPE), are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified; and ensuring that engineering controls in use are in proper operating conditions and are functioning properly. The Designated Competent Person shall be responsible for compliance with applicable federal, state and local requirements, the Contractor's Accident Prevention Plan and Asbestos Hazard Abatement Plan. The Designated Competent Person shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that this person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA competent person requirements. The Designated Competent Person shall be onsite at all times during the conduct of this project.

- b. Project Supervisors: The Contractor shall provide the name, address, telephone number, and resume of the Project Supervisor who have responsibility to implement the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses, the authority to direct work performed under this contract and verify compliance, and have EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by 40 CFR 763, Subpart E, Appendix C. The Project Supervisor shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that the Project Supervisor has a minimum of 2 years of on-the-job asbestos abatement experience relevant to project supervisor responsibilities.
- c. Designated Industrial Hygienist (IH) and Industrial Hygiene Technician (IHT):

The Contractor shall provide the name, address, telephone number, resume, and other information specified below for the IHT selected to prepare the Contractor's Asbestos Hazard Abatement Plan, prepare and perform any training, direct air monitoring and assist the Contractor's Competent Person in ensuring that safety and health requirements are complied with during the performance of all required work. The Designated IH shall be a person who is board certified in the practice of industrial hygiene as

determined and documented by the American Board of Industrial Hygiene (ABIH), have a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities and have EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training required by 40 CFR 763 Subpart E, Appendix C. The Designated IH shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Designated IH shall be completely independent from the Contractor according to federal, state, or local regulations; that is, shall not be a Contractor's employee or be an employee or principal of a firm in a business relationship with the Contractor negating such independent status.

A copy of the Designated IH's current valid ABIH certification shall be included. The Designated IH shall be on-site when requested by the IHT and shall be available for emergencies. The Contractor shall submit, the name, address, telephone numbers and resumes IHT who will be under the guidance of the Designated CIH and performing on-site tasks. IHT supporting the Designated IH shall have a minimum of 2 years of practical on-site asbestos abatement experience, and have a current air monitoring technician license per Texas Asbestos Health Protection Rules, Section 295.52, with the Texas Department of Health. The formal reporting relationship between the Designated IH, the IHT, the Designated Competent Person, and the Contractor shall be indicated in the Contractor's Asbestos Hazard Abatement Plan.

- d. Asbestos Abatement Workers: Asbestos abatement workers shall meet the requirements contained in 29 CFR 1926, Section .1101, 40 CFR 61, Subpart M, and other applicable federal, state and local requirements. Worker training documentation shall be provided as required on the "Certificate of Workers Acknowledgment" in this paragraph.
- e. Worker Training and Certification of Worker Acknowledgment: Training documentation will be required for each employee who will perform OSHA Class I, Class II, Class III, or Class IV asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment", to be completed for each employee in the same format and containing the same information as the example certificate at the end of this section. Training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached.
- f. Physician: The Contractor shall provide the name, medical qualifications, address, telephone number and resume of the physician who will or has performed the medical examinations and evaluations of the persons who will conduct the asbestos abatement work tasks. The physician shall be currently licensed by the state where the workers will be or have been examined, have expertise in pneumoconiosis and shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1926, Section .1101 and paragraph MEDICAL REQUIREMENTS. The physician shall be familiar with the site's hazards and the scope of this project.

- g. First Aid and CPR Trained Persons: The names of at least 2 persons who are currently trained in first aid and CPR by the American Red Cross or other approved agency shall be designated and shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section .1030 and shall be included in the Contractor's Bloodborne Pathogen Program. These persons may perform other duties but shall be immediately available to render first aid when needed. A copy of each designated person's current valid First Aid and CPR certificate shall be provided.
- h. Independent Testing Laboratory: The Contractor shall provide the name, address and telephone number of the independent testing laboratory selected to perform the sample analyses and report the results. The testing laboratory shall be completely independent from the Contractor as recognized by federal, state or local regulations. Written verification of the following criteria, signed by the testing laboratory principal and the Contractor, shall be submitted:

(1) Phase contrast microscopy (PCM): The laboratory is fully equipped and proficient in conducting PCM of airborne samples using the methods specified by 29 CFR 1926, Section .1101, OSHA method ID-160, the most current version of NIOSH Pub No. 84-100 Method 7400, and NIOSH Pub No. 84-100 Method 7402, transmission electron microscopy (TEM); the laboratory is currently judged proficient (classified as acceptable) in counting airborne asbestos samples by PCM by successful participation in each of the last 4 rounds in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program; the names of the selected microscopists who will analyze airborne samples by PCM with verified documentation of their proficiency to conduct PCM analyses by being judged proficient in counting samples as current participating analysts in the AIHA PAT Program, and having successfully completed the Asbestos Sampling and Analysis course (NIOSH 582 or equivalent) with a copy of course completion certificate provided; when the PCM analysis is to be conducted onsite, documentation shall be provided certifying that the onsite analyst meets the same requirements.

(2) Polarized light microscopy (PLM): The laboratory is fully equipped and proficient in conducting PLM analyses of suspect ACM bulk samples in accordance with 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for bulk asbestos analysis and will use analysts (names shall be provided) with demonstrated proficiency to conduct PLM to include its application to the identification and quantification of asbestos content.

(3) Transmission electron microscopy (TEM): The laboratory is fully equipped and proficient in conducting TEM analysis of airborne samples using the mandatory method specified by 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for airborne sample analysis of asbestos by TEM; the laboratory will use analysts (names shall be provided) that are currently evaluated as competent with demonstrated proficiency under the NIST NVLAP for airborne sample analysis of asbestos by TEM. The laboratory is proficient in conducting

analysis for low asbestos concentration, enhanced analysis of floor tiles and bulk materials where multiple layers are present, using an improved EPA test method titled, "Method for the Determination of Asbestos in Bulk Building Materials".

(4) PCM/TEM: The laboratory is fully equipped and each analyst (name shall be provided) possesses demonstrated proficiency in conducting PCM and TEM analysis of airborne samples using NIOSH Pub No. 84-100 Method 7400 PCM and NIOSH Pub No. 84-100 Method 7402 (TEM confirmation of asbestos content of PCM results) from the same filter.

- i. Disposal Facility, Transporter: The Contractor shall provide written evidence that the landfill to be used is approved for asbestos disposal by the state and local regulatory agencies. Copies of signed agreements between the Contractor (including subcontractors and transporters) and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste generated during the performance of this contract shall be provided. Qualifications shall be provided for each subcontractor or transporter to be used, indicating previous experience in transport and disposal of asbestos waste to include all required state and local waste hauler requirements for asbestos. The Contractor and transporters shall meet the DOT requirements of 49 CFR 171, 49 CFR 172, and 49 CFR 173 as well as registration requirements of 49 CFR 107 and other applicable state or local requirements. The disposal facility shall meet the requirements of 40 CFR 61, Sections .154 or .155, as required in 40 CFR 61, Section .150(b), and other applicable state or local requirements.

1.5.3 Federal, State or Local Citations on Previous Projects

The Contractor and all subcontractors shall submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company shall be provided.

1.6 REGULATORY REQUIREMENTS

In addition to detailed requirements of this specification, work performed under this contract shall comply with EM 385-1-1, applicable federal, state, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. This includes, but is not limited to, OSHA standards, 29 CFR 1926, especially Section .1101, 40 CFR 61, Subpart M and 40 CFR 763. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply. The following state and local laws, rules and regulations regarding demolition, removal, encapsulation, construction alteration, repair, maintenance, renovation, spill/emergency cleanup, housekeeping, handling, storing, transporting and disposing of asbestos

material apply: Texas Asbestos Health Protection Rules.

1.7 SAFETY AND HEALTH PROGRAM AND PLANS

The Contractor shall develop and submit a written comprehensive site-specific Accident Prevention Plan at least 30 days prior to the preconstruction conference. The Accident Prevention Plan shall address requirements of EM 385-1-1, Appendix A, covering onsite work to be performed by the Contractor and subcontractors. The Accident Prevention Plan shall incorporate an Asbestos Hazard Abatement Plan, and Activity Hazard Analyses as separate appendices into 1 site specific Accident Prevention Plan document. Any portions of the Contractor's overall Safety and Health Program that are referenced in the Accident Prevention Plan, e.g., respirator program, hazard communication program, confined space entry program, etc., shall be included as appendices to the Accident Prevention Plan. The plan shall take into consideration all the individual asbestos abatement work tasks identified in Table 1. The plan shall be prepared, signed (and sealed, including certification number if required), and dated by the Contractor's Designated IH, Competent Person, and Project Supervisor.

1.7.1 Asbestos Hazard Abatement Plan Appendix

The Asbestos Hazard Abatement Plan appendix to the Accident Prevention Plan shall include, but not be limited to, the following:

- a. The personal protective equipment to be used;
- b. The location and description of regulated areas including clean and dirty areas, access tunnels, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);
- c. Initial exposure assessment in accordance with 29 CFR 1926, Section .1101;
- d. Level of supervision;
- e. Method of notification of other employers at the worksite;
- f. Abatement method to include containment and control procedures;
- g. Interface of trades involved in the construction;
- h. Sequencing of asbestos related work;
- i. Storage and disposal procedures and plan;
- j. Type of wetting agent and asbestos encapsulant to be used;
- k. Location of local exhaust equipment;
- l. Air monitoring methods (i.e. personal, environmental and clearance);
- m. Bulk sampling and analytical methods (if required and as approved by the Contracting Officer);
- n. A detailed description of the method to be employed in order to

control the spread of ACM wastes and airborne fiber concentrations (if possible, remove employees in adjacent work areas during asbestos abatement);

- o. Fire and medical emergency response procedures;
- p. The security procedures to be used for all regulated areas.
- q. The type of hygiene facility to be used.
- r. Surfaces that required precleaning.

1.7.2 Activity Hazard Analyses Appendix

Activity Hazard Analyses, for each major phase of work, shall be submitted and updated during the project. The Activity Hazard Analyses format shall be in accordance with EM 385-1-1 (Figure 1-1). The analysis shall define the activities to be performed for a major phase of work, identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analyses has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the onsite Government representatives. The Activity Hazard Analyses shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations.

1.8 PRECONSTRUCTION CONFERENCE AND ONSITE SAFETY

The Contractor and the Contractor's Designated Competent Person, Project Supervisor, and Designated CIH shall meet with the Contracting Officer prior to beginning work at a safety preconstruction conference to discuss the details of the Contractor's submitted Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses appendices. Deficiencies in the Accident Prevention Plan will be discussed and the Accident Prevention Plan shall be revised to correct the deficiencies and resubmitted for acceptance. Any changes required in the specification as a result of the Accident Prevention Plan shall be identified specifically in the plan to allow for free discussion and acceptance by the Contracting Officer, prior to the start of work. Onsite work shall not begin until the Accident Prevention Plan has been accepted. A copy of the written Accident Prevention Plan shall be maintained onsite. Changes and modifications to the accepted Accident Prevention Plan shall be made with the knowledge and concurrence of the Designated CIH, the Project Supervisor, Designated Competent Person, and the Contracting Officer. Should any unforeseen hazard become evident during the performance of the work, the Designated CIH shall bring such hazard to the attention of the Project Supervisor, Designated Competent Person, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Once accepted by the Contracting Officer, the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses will be enforced as if an addition to the contract. Disregarding the provisions of this contract or the accepted Accident Prevention Plan will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

1.9 SECURITY

Fenced and locked security areas shall be provided for each regulated area. A log book shall be kept documenting entry into and out of the regulated area. Entry into regulated areas shall only be by personnel authorized by the Contractor and the Contracting Officer. Personnel authorized to enter regulated areas shall be trained, be medically evaluated, and wear the required personal protective equipment for the specific regulated area to be entered.

1.10 MEDICAL REQUIREMENTS

Medical requirements shall conform to 29 CFR 1926, Section .1101.

1.10.1 Medical Examinations

Before being exposed to airborne asbestos fibers, workers shall be provided with a medical examination as required by 29 CFR 1926, Section .1101 and other pertinent state or local requirements. This requirement shall have been satisfied within the last 12 months. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. X-ray films of asbestos workers shall be identified to the consulting radiologist and medical record jackets shall be marked with the word "asbestos."

1.10.1.1 Information Provided to the Physician

The Contractor shall provide the following information in writing to the examining physician:

- a. A copy of 29 CFR 1926, Section .1101 and Appendices D, E, G, and I;
- b. A description of the affected employee's duties as they relate to the employee's exposure; a copy of 29 CFR 1910, Section .134 and Appendix D;
- c. The employee's representative exposure level or anticipated exposure level;
- d. A description of any personal protective and respiratory equipment used or to be used; and all supplemental information in compliance with 29 CFR 1910, Section .134 (e);
- e. Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

1.10.1.2 Written Medical Opinion

For each worker, a written medical opinion prepared and signed by a licensed physician indicating the following:

- a. Summary of the results of the examination.
- b. The potential for an existing physiological condition that would place the employee at an increased risk of health impairment from exposure to asbestos.

- c. The ability of the individual to wear personal protective equipment, including respirators, while performing strenuous work tasks under cold and/or heat stress conditions.
- d. A statement that the employee has been informed of the results of the examination, provided with a copy of the results, informed of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure, and informed of any medical condition that may result from asbestos exposure.

1.10.2 Medical and Exposure Records

Complete and accurate records shall be maintained of each employee's medical examinations, medical records, and exposure data, as required by 29 CFR 1910, Section .1910.20 and 29 CFR 1926, Section .1101 for a period of 30 years after termination of employment. Records of the required medical examinations and exposure data shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health (OSHA) or authorized representatives of the employee and an employee's physician upon request of the employee or former employee. A copy of the required medical certification for each employee shall be maintained on file at the worksite for review, as requested by the Contracting Officer or the representatives.

1.11 TRAINING PROGRAM

1.11.1 General Training Requirements

The Contractor shall establish a training program as specified by EPA Model Accreditation Plan (MAP), training requirements at 40 CFR 763, Subpart E, Appendix C, the State of Texas Sections 295.64 and 295.65, OSHA requirements at 29 CFR 1926, Section .1101(k)(9), and this specification. Contractor employees shall complete the required training for the type of work they are to perform and such training shall be documented and provided to the Contracting Officer as specified in paragraph QUALIFICATIONS.

1.11.2 Project Specific Training

Prior to commencement of work, each worker shall be instructed by the Contractor's Designated IH and Competent Person in the following project specific training:

- a. The hazards and health effects of the specific types of ACM to be abated;
- b. The content and requirements of the Contractor's Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses and site-specific safety and health precautions;
- c. Hazard Communication Program;
- d. Hands-on training for each asbestos abatement technique to be employed;
- e. Heat and/or cold stress monitoring specific to this project;
- f. Air monitoring program and procedures;

- g. Medical surveillance to include medical and exposure record-keeping procedures;
- h. The association of cigarette smoke and asbestos-related disease;
- i. Security procedures;
- j. Specific work practice controls and engineering controls required for each Class of work in accordance with 29 CFR 1926, Section .1101.

1.12 RESPIRATORY PROTECTION PROGRAM

The Contractor's Designated CIH shall establish in writing, and implement a respiratory protection program in accordance with 29 CFR 1926, Section .1101, 29 CFR 1910, Section .134, ANSI Z88.2, CGA G-7, CGA G-7.1. The Contractor's Designated IH shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations encountered during the performance of the asbestos abatement work. The Contractor's respiratory protection program shall include, but not be limited to, the following elements:

- a. The company policy, used for the assignment of individual responsibility, accountability, and implementation of the respiratory protection program.
- b. The standard operating procedures covering the selection and use of respirators. Respiratory selection shall be determined by the hazard to which the worker is exposed.
- c. Medical evaluation by a physician or other licensed health care professionals, with the Mandatory Evaluation Questionnaire in 29 CFR 1910, Section .132, Appendix C for the employee's fit testing or workers who are required to use respirator (e)(1)..
- d. Training in the proper use and limitations of respirators.
- e. Respirator fit-testing, i.e., quantitative, qualitative and individual functional fit checks.
- f. Regular cleaning and disinfection of respirators.
- g. Routine inspection of respirators during cleaning and after each use when designated for emergency use.
- h. Storage of respirators in convenient, clean, and sanitary locations.
- i. Surveillance of regulated area conditions and degree of employee exposure (e.g., through air monitoring).
- j. Regular evaluation of the continued effectiveness of the respiratory protection program.
- k. Recognition and procedures for the resolution of special problems as they affect respirator use (e.g., no facial hair that comes between the respirator face piece and face or interferes with valve function; prescription eye wear usage; contact lenses usage; etc.).

1. Proper training in putting on and removing respirators.

- 1.12.1 Respiratory Fit Testing

A qualitative or quantitative fit test conforming to 29 CFR 1926, Section 1101, Appendix C shall be conducted by the Contractor's Designated CIH for each Contractor worker required to wear a respirator, and for the Contracting Officer and authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test shall be performed for each worker wearing a negative-pressure respirator prior to initially wearing a respirator on this project and every 6 months thereafter. The qualitative fit tests may be used only for testing the fit of negative pressure air-purifying respirator that must achieve a fit factor of 100 or less. If physical changes develop that will affect the fit, a new fit test for the worker shall be performed. Functional fit checks shall be performed by employees each time a respirator is put on and in accordance with the manufacturer's recommendation.

- 1.12.2 Respirator Selection and Use Requirements

The Contractor shall provide respirators, and ensure that they are used as required by 29 CFR 1926, Section .1101, and 29 CFR 1910 Section .134 and in accordance with the manufacturer's recommendations. Respirators shall be jointly approved by the National Institute for Occupational Safety and Health (NIOSH), under the provisions of 42 CFR 84, N100, R100, P100 particulate filters for use in environments containing airborne asbestos fibers. Personnel who handle ACM, enter regulated areas that require the wearing of a respirator, or who are otherwise carrying out abatement activities that require the wearing of a respirator, shall be provided with approved respirators that are fully protective of the worker at the measured or anticipated airborne asbestos concentration level to be encountered. For air-purifying respirators, the particulate filter portion of the cartridges or canister approved for use in airborne asbestos environments shall be N100, R100, P100 particulate filters per 42 CFR 84. The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type shall be made by the Contractor's IHT with documented approval of Designated CIH, based on the measured or anticipated airborne asbestos fiber concentrations to be encountered (as recorded by the IHT). Recommendations made by the Contractor's IHT to downgrade respirator type, with the written approval of the Designated CIH, shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person, IHT, in consultation with the Designated CIH, shall have the authority to take immediate action to upgrade or downgrade respiratory type when there is an immediate danger to the health and safety of the wearer. Respirators shall be used in the following circumstances:

- a. During all Class I asbestos jobs.
- b. During all Class II work where the ACM is not removed in a substantially intact state.
- c. During all Class II work which is not performed using wet methods. Respirators need not be worn during removal of ACM from sloped roofs when a negative exposure assessment has been made and ACM is removed in an intact state.
- d. During all Class II asbestos jobs where the Contractor does not produce a negative exposure assessment.

e. During all work where employees are exposed above the PEL-TWA or PEL-Excursion Limit.

f. In emergencies

1.12.3 Class I Work

For Class I work, the Contractor shall provide: (1) a tight-fitting, powered air purifying respirator equipped with N100, R100 or P100, or (2) a full-facepiece supplied air respirator operated in the pressure demand mode, equipped with HEPA egress cartridges, or (3) an auxiliary positive pressure self-contained breathing apparatus, for all employees within the regulated area where Class I work is being performed; provided that a negative exposure assessment has not been produced, and that the exposure level will not exceed 1 f/cc as an 8-hour time weighted average. A full-facepiece supplied air respirator, operated in the pressure demand mode, equipped with an auxiliary positive pressure self-contained breathing apparatus shall be provided under such conditions, if the exposure assessment indicates exposure levels above 1 f/cc as an 8-hour time weighted average.

1.12.4 Class II Work

The Contractor shall provide an air purifying respirator, other than a disposable respirator, equipped with high-efficiency filters whenever the employee performs Class II asbestos jobs where the Contractor does not produce a negative exposure assessment.

1.12.5 Sanitation

Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

1.13 HAZARD COMMUNICATION PROGRAM

A hazard communication program shall be established and implemented in accordance with 29 CFR 1926, Section .59. Material safety data sheets (MSDSs) shall be provided for all hazardous materials brought onto the worksite. One copy shall be provided to the Contracting Officer and 1 copy shall be included in the Contractor's Hazard Communication Program.

1.14 LICENSES, PERMITS AND NOTIFICATIONS

1.14.1 General Legal Requirements

Necessary licenses, permits and notifications shall be obtained in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify the Texas Department of Health, Asbestos Program Branch, Austin, Texas, in writing, at least 20 working days prior to the commencement of work, including the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents. Notification shall be by Certified Mail, Return Receipt Requested. Notification shall be signed by a representative of DPW-Environmental who has signature authority. The Contractor shall furnish copies of the receipts to the Contracting Officer, prior to the commencement of work. Local fire department shall be notified 3 days before fire-proofing

material is removed from a building and the notice shall specify whether or not the material contains asbestos. A copy of the rental company's written acknowledgment and agreement shall be provided as required by paragraph RENTAL EQUIPMENT. For licenses, permits, and notifications that the Contractor is responsible for obtaining, the Contractor shall pay any associated fees or other costs incurred.

1.14.2 Litigation and Notification

The Contractor shall notify the Contracting Officer if any of the following occur:

- a. The Contractor or any of the subcontractors are served with notice of violation of any law, regulation, permit or license which relates to this contract;
- b. Proceedings are commenced which could lead to revocation of related permits or licenses; permits, licenses or other Government authorizations relating to this contract are revoked;
- c. Litigation is commenced which would affect this contract;
- d. The Contractor or any of the subcontractors become aware that their equipment or facilities are not in compliance or may fail to comply in the future with applicable laws or regulations.

1.15 PERSONAL PROTECTIVE EQUIPMENT

One (1) complete set of personal protective equipment shall be made available to the Contracting Officer and authorized visitors for entry to the regulated area. Contracting Officer and authorized visitors shall be provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of the required personal protective equipment and the site safety and health requirements. Contractor workers shall be provided with personal protective clothing and equipment and the Contractor shall ensure that it is worn properly. The Contractor's Designated IH and Designated Competent Person shall select and approve all the required personal protective clothing and equipment to be used.

1.15.1 Respirators

Respirators shall be in accordance with paragraph RESPIRATORY PROTECTION PROGRAM.

1.15.2 Whole Body Protection

Personnel exposed to airborne concentrations of asbestos that exceed the PELs, or for all OSHA Classes of work for which a required negative exposure assessment is not produced, shall be provided with whole body protection and such protection shall be worn properly. The Contractor's Designated IH and Competent Person shall select and approve the whole body protection to be used. The Competent Person shall examine work suits worn by employees at least once per work shift for rips or tears that may occur during performance of work. When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the work suit shall be immediately replaced. Disposable whole body protection shall be disposed of as asbestos contaminated waste upon exiting from the regulated area. Reusable whole body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the regulated

area or be properly laundered in accordance with 29 CFR 1926, Section .1101.

Whole body protection used for asbestos abatement shall not be removed from the worksite by a worker to be cleaned. Recommendations made by the Contractor's IHT (with written approval of Designated IH) to downgrade whole body protection shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person, IHT, in consultation with the Designated IH, has the authority to take immediate action to upgrade or downgrade whole body protection when there is an immediate danger to the health and safety of the wearer.

1.15.2.1 Coveralls

Disposable-breathable coveralls with a zipper front shall be provided as the approved Contractor's Asbestos Hazard Abatement Plan. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles. See DETAIL SHEET 13.

1.15.2.2 Underwear

Disposable underwear shall be provided. If reusable underwear are used, they shall be disposed of as asbestos contaminated waste or laundered in accordance with 29 CFR 1926, Section .1101. Asbestos abatement workers shall not remove contaminated reusable underwear worn during abatement of ACM from the site to be laundered.

1.15.2.3 Work Clothing

An additional coverall shall be provided when the abatement and control method employed does not provide for the exit from the regulated area directly into an attached decontamination unit. Cloth work clothes for wear under the protective coverall, and foot coverings, shall be provided when work is being conducted in low temperature conditions. Cloth work clothes shall be either disposed of as asbestos contaminated waste or properly laundered in accordance with 29 CFR 1926, Section .1101.

1.15.2.4 Gloves

Gloves shall be provided to protect the hands. Where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.) a suitable glove shall be provided and used.

1.15.2.5 Foot Coverings

Cloth socks shall be provided and worn next to the skin. Footwear, as required by OSHA and EM 385-1-1, that is appropriate for safety and health hazards in the area shall be worn. Rubber boots shall be used in moist or wet areas. Reusable footwear removed from the regulated area shall be thoroughly decontaminated or disposed of as ACM waste. Disposable protective foot covering shall be disposed of as ACM waste. If rubber boots are not used, disposable foot covering shall be provided.

1.15.2.6 Head Covering

Hood type disposable head covering shall be provided. In addition, protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the regulated area after being thoroughly decontaminated.

1.15.2.7 Protective Eye Wear

Eye protection provided shall be in accordance with ANSI Z87.1.

1.16 HYGIENE FACILITIES AND PRACTICES

The Contractor shall establish a decontamination area for the decontamination of employees, material and equipment. The Contractor shall ensure that employees enter and exit the regulated area through the decontamination area.

1.16.1 Shower Facilities

Shower facilities, when provided, shall comply with 29 CFR 1910, Section .141(d)(3).

1.16.2 3-Stage Decontamination Area

A temporary negative pressure decontamination unit that is adjacent and attached in a leak-tight manner to the regulated area shall be provided as described in the approved Contractor's Asbestos Hazard Abatement Plan. Utilization of prefabricated units shall have prior approval of the Contracting Officer. The decontamination unit shall have an equipment room and a clean room separated by a shower that complies with 29 CFR 1910, Section .141 (unless the Contractor can demonstrate that such facilities are not feasible). Equipment and surfaces of containers filled with ACM shall be cleaned prior to removing them from the equipment room or area. Surfaces of the equipment room shall be wet wiped 2 times after each shift.

Materials used for wet wiping shall be disposed of as asbestos contaminated waste. Two separate lockers shall be provided for each asbestos worker, one in the equipment room and one in the clean room. Hot water service may be secured from the building hot water system provided backflow protection is installed by the Contractor at the point of connection. Should sufficient hot water be unavailable, the Contractor shall provide a minimum 40 gal. electric water heater with minimum recovery rate of 20 gal. per hour and a temperature controller for each showerhead. The Contractor shall provide a minimum of 2 showers. Instantaneous type in-line water heater may be incorporated at each shower head in lieu of hot water heater, upon approval by the Contracting Officer.

Flow and temperature controls shall be located within the shower and shall be adjustable by the user. The wastewater pump shall be sized for 1.25 times the showerhead flow-rate at a pressure head sufficient to satisfy the filter head loss and discharge line losses. The pump shall supply a minimum 25 gpm flow with 35 ft. of pressure head. Used shower water shall be collected and filtered to remove asbestos contamination. Filters and residue shall be disposed of as asbestos contaminated material. Filtered water shall be discharged to the sanitary system. Wastewater filters shall be installed in series with the first stage pore size of 20 microns and the second stage pore size of 5 microns. The floor of the decontamination unit's clean room shall be kept dry and clean at all times. Water from the shower shall not be allowed to wet the floor in the clean room. Surfaces of the clean room and shower shall be wet-wiped 2 times after each shift change with a disinfectant solution. Proper housekeeping and hygiene requirements shall be maintained. Soap and towels shall be provided for showering, washing and drying. Any cloth towels provided shall be disposed of as ACM waste or shall be laundered in accordance with 29 CFR 1926, Section .1101.

1.16.3 Load-Out Unit

A temporary load-out unit that is adjacent and connected to the regulated

area shall be provided as described in the Contractor's Asbestos Hazard Abatement Plan. Utilization of prefabricated units shall have prior approval of the Contracting Officer. The load-out unit shall be attached in a leak-tight manner to each regulated area. Surfaces of the load-out unit shall be adequately wet-wiped 2 times after each shift change. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.4 Single Stage Decontamination Area

A decontamination area (equipment room/area) shall be provided for Class I work involving less than 25 feet or 10 square feet of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment produced before the operation. The equipment room or area shall be adjacent to the regulated area for the decontamination of employees, material, and their equipment which is contaminated with asbestos. The equipment room or area shall consist of an area covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area. Surfaces of the equipment room shall be wet wiped 2 times after each shift. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.5 Decontamination Area Entry Procedures

The Contractor shall ensure that employees entering the decontamination area through the clean room or clean area:

- a. Remove street clothing in the clean room or clean area and deposit it in lockers.
- b. Put on protective clothing and respiratory protection before leaving the clean room or clean area.
- c. Pass through the equipment room to enter the regulated area.

1.16.6 Decontamination Area Exit Procedures

The Contractor shall ensure that the following procedures are followed:

- a. Before leaving the regulated area, respirators shall be worn while employees remove all gross contamination and debris from their work clothing using a HEPA vacuum.
- b. Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers (see Detail Sheets 9 and 14) for disposal and/or laundering.
- c. Employees shall not remove their respirators in the equipment room.
- d. Employees shall shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, the Contractor shall ensure that employees engaged in Class I asbestos jobs: a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a

shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.

- e. After showering, employees shall enter the clean room before changing into street clothes.

1.16.7 Lunch Areas

The Contractor shall provide lunch areas in which the airborne concentrations of asbestos are below 0.01 f/cc.

1.16.8 Smoking

Smoking, if allowed by the Contractor, shall only be permitted in designated areas approved by the Contracting Officer.

1.17 REGULATED AREAS

All Class I and II asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they shall demarcate the regulated area. Access to regulated areas shall be limited to authorized persons. The Contractor shall control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

1.18 WARNING SIGNS AND TAPE

Warning signs and tape printed bilingually, in English and Spanish shall be provided at the regulated boundaries and entrances to regulated areas. The Contractor shall ensure that all personnel working in areas contiguous to regulated areas comprehend the warning signs. Signs shall be located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs shall be in vertical format conforming to 29 CFR 1910 and 29 CFR 1926, Section .1101, a minimum of 20 by 14 inches, and displaying the following legend in the lower panel:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

PELIGRO
ASBESTOS
PRECAUCION ENFERMEDADES DEL CANCER Y PULMON
SOLAMENTE AUTORIZADO PERSONAL

Spacing between lines shall be at least equal to the height of the upper of any two lines. Warning tape shall be provided. Decontamination unit signage shall be posted.

1.19 WARNING LABELS

Warning labels shall be affixed to all asbestos disposal containers used to

contain asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable. Warning labels shall conform to 29 CFR 1926, Section .1101 and shall be of sufficient size to be clearly legible displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

PELIGRO
CONTIENE FIBRAS DE ASBESTOS
EVITE LA CREACION DE POLVO
PRECAUCION ENFERMEDADES DEL CANCER Y PULMON

1.20 LOCAL EXHAUST VENTILATION

Local exhaust ventilation units shall conform to ANSI Z9.2 and 29 CFR 1926, Section .1101. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586. Filter shall be UL labeled.

1.21 TOOLS

Vacuums shall be leak proof to the filter, equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system, or has otherwise been approved for use by the Contracting Officer. Residual asbestos shall be removed from reusable tools prior to storage and reuse. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

1.22 RENTAL EQUIPMENT

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment. A written acceptance of the terms of the Contractor's notification shall be obtained from the rental agency.

1.23 AIR MONITORING EQUIPMENT

The Contractor's Designated CIH shall approve air monitoring equipment to be used to collect samples. The equipment shall include, but shall not be limited to:

- a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute when equipped with a sampling train of tubing and filter cassette.
- b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute when equipped with a sampling train of tubing and filter cassette, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped

with an automatic flow control unit which shall maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

- c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands, to be used with low flow pumps in accordance with 29 CFR 1926, Section .1101 for personal air sampling.
- d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands, to be used with high flow pumps when conducting environmental area sampling using NIOSH Pub No. 84-100 Methods 7400 and 7402.
- e. Appropriate plastic tubing to connect the air sampling pump to the selected filter cassette.
- f. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

1.24 EXPENDABLE SUPPLIES

1.24.1 Glovebag

Glovebags shall be provided as described in 29 CFR 1926, Section .1101. The glovebag assembly shall be 6 mil thick plastic, prefabricated and seamless at the bottom with preprinted OSHA warning label.

1.24.2 Duct Tape

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container shall be provided.

1.24.3 Disposal Containers

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers shall be provided for ACM wastes as required by 29 CFR 1926 Section .1101.

1.24.4 Disposal Bags

Leak-tight bags, 6 mil thick, shall be provided for placement of asbestos generated waste.

1.24.5 Sheet Plastic

Sheet plastic shall be polyethylene of 6 mil minimum thickness and shall be provided in the largest sheet size necessary to minimize seams, as indicated on the Contractor's Asbestos Hazard Abatement Plan. Film shall be frosted and conform to ASTM D 4397, except as specified below:

1.24.5.1 Flame Resistant

Where a potential for fire exists, flame-resistant sheets shall be provided. Film shall be frosted and shall conform to the requirements of

NFPA 701.

1.24.5.2 Reinforced

Reinforced sheets shall be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

1.24.6 Amended Water

Amended water shall meet the requirements of ASTM D 1331.

1.24.7 Mastic Removing Solvent

Mastic removing solvent shall be nonflammable and shall not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite shall have a flash point greater than 140 degrees F.

1.24.8 Leak-tight Wrapping

Two layers of 6 mil minimum thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

1.24.9 Viewing Inspection Window

Where feasible, a minimum of 1 clear, 1/8 inch thick, acrylic sheet, 18 by 24 inches, shall be installed as a viewing inspection window at eye level on a wall in each containment enclosure as indicated in the approved Contractor's Asbestos Hazard Abatement Plan. The windows shall be sealed leak-tight with industrial grade duct tape.

1.24.10 Wetting Agents

Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS.

1.24.11 Strippable Coating

Strippable coating in aerosol cans shall be used to adhere to surfaces and to be removed cleanly by stripping, at the completion of work. This work shall only be done in well ventilated areas.

1.25 MISCELLANEOUS ITEMS

A sufficient quantity of other items, such as, but not limited to: scrapers, brushes, brooms, staple guns, tarpaulins, shovels, rubber squeegees, dust pans, other tools, scaffolding, staging, enclosed chutes, wooden ladders, lumber necessary for the construction of containments, UL

approved temporary electrical equipment, material and cords, ground fault circuit interrupters, water hoses of sufficient length, fire extinguishers, first aid kits, portable toilets, logbooks, log forms, markers with indelible ink, spray paint in bright color to mark areas, project boundary fencing, etc., shall be provided.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent and shall meet the following requirements:

ALL ENCAPSULANTS

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E 84
Combustion Toxicity Zero Mortality	Univ. of Pittsburgh Protocol
Life Expectancy, 20 yrs Accelerated Aging Test	ASTM C 732
Permeability, Minimum 0.4 perms	ASTM E 96

Additional Requirements for Bridging Encapsulant

Requirement	Test Standard
Cohesion/Adhesion Test, 50 pounds of force/foot	ASTM E 736
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E 119
Impact Resistance, Minimum 43 in-lb (Gardner Impact Test)	ASTM D 2794
Flexibility, no rupture or cracking (Mandrel Bend Test)	ASTM D 522

Additional Requirements for Penetrating Encapsulant

Requirement	Test Standard
Cohesion/Adhesion Test, 50 pounds of force/foot	ASTM E 736
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E 119
Impact Resistance, Minimum 43 in-lb (Gardner Impact Test)	ASTM D 2794
Flexibility, no rupture or cracking (Mandrel Bend Test)	ASTM D 522

ALL ENCAPSULANTS

Requirement	Test Standard
Additional Requirements for Lockdown Encapsulant	
Requirement	Test Standard
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Tested with fireproofing over encapsulant applied directly to steel member)	ASTM E 119
Bond Strength, 100 pounds of force/foot (Tests compatibility with cementitious and fibrous fireproofing)	ASTM E 736

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Asbestos abatement work tasks shall be performed as summarized in paragraph DESCRIPTION OF WORK ((including Table 1) and the Contractor's Accident Prevention Plan, Asbestos Hazard Abatement Plan, and the Activity Hazard Analyses. The Contractor shall use the engineering controls and work practices required in 29 CFR 1926, Section .1101(g) in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and equipment as in the approved Contractor's Asbestos Hazard Abatement Plan. The Contractor shall not permit eating, smoking, drinking, chewing or applying cosmetics in the regulated area. All hot work (burning, cutting, welding, etc.) shall be conducted under controlled conditions in conformance with 29 CFR 1926, Section .352, Fire Prevention. Personnel of other trades, not engaged in asbestos abatement activities, shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's Accident Prevention Plan are complied with. Power to the regulated area shall be locked-out and tagged in accordance with 29 CFR 1910, and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. The Contractor shall stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. The Contractor shall correct the condition to the satisfaction of the Contracting Officer, including visual inspection and air sampling. Work shall resume only upon notification by the Contracting Officer. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

Asbestos abatement shall be performed without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, as verified by the Contracting Officer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government, as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust or debris in which it is reasonable to conclude that asbestos may exist. When

these spills occur, work shall stop in all effected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's IHT, in consultation with the Designated CIH as needed, and the COR, work shall proceed.

3.3 OBJECTS

3.3.1 Removal of Mobile Objects

Mobile objects, furniture, and equipment will be removed from the area of work by the Government before asbestos abatement work begins. The Contractor shall coordinate such work with the COR.

3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS

Building ventilating systems supplying air into or returning air out of a regulated area shall be shut down and isolated by lockable switch or other positive means in accordance with 29 CFR 1910, Section .147 and isolated by airtight seals to prevent the spread of contamination throughout the system. Air-tight critical barriers shall be installed on building ventilating openings located inside the regulated area that supply or return air from the building ventilation system or serve to exhaust air from the building. The critical barriers shall consist of 2 layers of polyethylene. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape.

3.5 PRECLEANING

The Contractor shall identify surfaces to be precleaned in the Contractor's Asbestos Hazard Abatement Plan. Surfaces shall be cleaned by HEPA vacuum and adequately wet wiped prior to establishment of containment.

3.6 METHODS OF COMPLIANCE

3.6.1 Mandated Practices

The Contractor shall employ proper handling procedures in accordance with 29 CFR 1926 and 40 CFR 61, Subpart M, and the specified requirements. The specific abatement techniques and items identified shall be detailed in the Contractor's Asbestos Hazard Abatement Plan including, but not limited to, details of construction materials, equipment, and handling procedures. The Contractor shall use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

- a. Vacuum cleaners equipped with HEPA filters to collect debris and dust containing ACM.
- b. Wet methods or wetting agents to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup; except where it can be demonstrated that the use of wet methods is unfeasible due to, for example, the creation of electrical hazards, equipment malfunction, and in roofing.
- c. Prompt clean-up and disposal in leak-tight containers of wastes and debris contaminated with asbestos.
- d. Inspection and repair of polyethylene in work and high traffic areas.

- e. Cleaning of equipment and surfaces of containers filled with ACM prior to removing them from the equipment room or area.

3.6.2 Control Methods

The Contractor shall use the following control methods to comply with the PELs:

- a. Local exhaust ventilation equipped with HEPA filter dust collection systems;
- b. Enclosure or isolation of processes producing asbestos dust;
- c. Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;
- d. Use of other work practices and engineering controls;
- e. Where the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the PELs, the Contractor shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with paragraph, RESPIRATORY PROTECTION PROGRAM.

3.6.3 Unacceptable Practices

The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

- a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.
- b. Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.
- c. Dry sweeping, shoveling, or other dry clean-up of dust and debris containing ACM.
- d. Employee rotation as a means of reducing employee exposure to asbestos.

3.6.4 Class I Work Procedures

For Class I asbestos work, the following engineering controls and work practices shall be used, in addition to requirements of paragraphs Mandated Practices and Control Methods:

- a. A Competent Person shall supervise the installation and operation of the control system.
- b. For jobs involving the removal of more than 25 feet or 10 square

feet of TSI or surfacing material, the Contractor shall place critical barriers over all openings to the regulated area.

- c. HVAC systems shall be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.
- d. Impermeable dropcloths (6 mil or greater thickness) shall be placed on surfaces beneath all removal activity.
- e. Objects within the regulated area shall be handled as specified in paragraph OBJECTS.
- f. Where a negative exposure assessment has not been provided or where exposure monitoring shows the PEL was exceeded, the regulated area shall be ventilated to move contaminated air away from the employee's breathing zone toward a HEPA unit or collection device.

3.6.5 Specific Control Methods for Class I Work

In addition to requirements of paragraph Class I Work Procedures, Class I asbestos work shall be performed using the control methods identified in the subparagraphs below.

3.6.5.1 Negative Pressure Enclosure (NPE) System

The NPE system shall provide at least 4 air changes per hour inside the containment. The local exhaust unit equipment shall be operated 24 hours per day until the containment is removed, and shall be leak-proof to the filter and equipped with HEPA filters. Air movement shall be directed away from the employees and toward a HEPA filtration device. The NPE shall be smoke tested for leaks at the beginning of each shift. Local exhaust equipment shall be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential shall be monitored continuously, 24 hours per day, with an automatic manometric recording instrument. Pressure differential recordings shall be provided daily on the same day collected. Readings shall be reviewed by the Contractor's Designated Competent Person and IH prior to submittal. The Contracting Officer shall be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system shall not be used as the local exhaust system for the regulated area. The local exhaust system shall terminate outdoors unless an alternate arrangement is allowed by the Contract Officer. All filters used shall be new at the beginning of the project and shall be periodically changed as necessary and disposed of as ACM waste.

3.6.5.2 Glovebag Systems

The glovebag system shall be used to remove ACM from straight runs of piping and elbows and other connections. Glovebags shall be used without modification and shall be smoke-tested for leaks and any leaks sealed prior to use. Glovebags shall be installed to completely cover the circumference of pipe or other structures where the work is to be done. Glovebags shall be used only once and shall not be moved. Glovebags shall not be used on surfaces that have temperatures exceeding 150 degrees F. Prior to disposal, glovebags shall be collapsed by removing air within them using a HEPA vacuum. Before beginning the operation, loose and friable material adjacent to the glovebag operation shall be wrapped and sealed in 2 layers of plastic or otherwise rendered intact. At least 2 persons shall perform

Class I glovebag removal. Asbestos regulated work areas shall be established as specified and shown on detailed drawings and plans for glovebag abatement. Designated boundary limits for the asbestos work shall be established with rope or other continuous barriers and all other requirements for asbestos control areas shall be maintained, including area signage and boundary warning tape.

- a. In addition to requirements for negative pressure glovebag systems above, the Contractor shall attach HEPA vacuum systems or other devices to the bag to prevent collapse during removal of ACM from straight runs of piping and elbows and other connections.
- b. The negative pressure glove boxes used to remove ACM from pipe runs shall be fitted with gloved apertures and a bagging outlet and constructed with rigid sides from metal or other material which can withstand the weight of the ACM and water used during removal. A negative pressure shall be created in the system using a HEPA filtration system. The box shall be smoke tested for leaks prior to each use.

3.6.5.3 Mini-Enclosures

Mini-containment (small walk-in enclosure) to accommodate no more than 2 persons, may be used if the disturbance or removal can be completely contained by the enclosure with the Class I work procedures. The mini-enclosure shall be inspected for leaks and smoke tested before each use. Air movement shall be directed away from the employee's breathing zone within the mini-enclosure.

3.6.6 Class II Work

In addition to the requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

- a. A Competent Person shall supervise the work.
- b. For indoor work, critical barriers shall be placed over all openings to the regulated area.
- c. Impermeable dropcloths shall be placed on surfaces beneath all removal activity.

3.6.7 Specific Control Methods for Class II Work

In addition to requirements of paragraph Class II Work, Class II work shall be performed using the following methods:

3.6.7.1 Vinyl and Asphalt Flooring Materials

Resilient sheeting shall be removed by adequately wet methods. Tiles shall be removed intact (if possible); wetting is not required when tiles are heated and removed intact. Flooring or its backing shall not be sanded. Scraping of residual adhesive and/or backing shall be performed using wet methods. Mechanical chipping is prohibited unless performed in a negative pressure enclosure. Dry sweeping is prohibited. The Contractor shall use vacuums equipped with HEPA filter, disposable dust bag, and metal floor

tool (no brush) to clean floors.

3.6.7.2 Other Class II Jobs

The Contractor shall use the following work practices when performing Class II removal of ACM listed in Table 1: The material shall be thoroughly wetted with amended water prior and during its removal. The material shall be removed in an intact state. Cutting, abrading or breaking the material is prohibited. The ACM removed shall be immediately bagged or wrapped.

3.6.8 Cleaning After Asbestos Removal

After completion of all asbestos removal work, surfaces from which ACM has been removed shall be wet wiped or sponged clean, or cleaned by some equivalent method to remove all visible residue. Run-off water shall be collected and filtered through a dual filtration system. A first filter shall be provided to remove fibers 20 micrometers and larger, and a final filter provided that removes fibers 5 micrometers and larger. After the gross amounts of asbestos have been removed from every surface, remaining visible accumulations of asbestos on floors shall be collected using plastic shovels, rubber squeegees, rubber dustpans, and HEPA vacuum cleaners as appropriate to maintain the integrity of the regulated area. When TSI and surfacing material has been removed, workmen shall use HEPA vacuum cleaners to vacuum every surface. Surfaces or locations which could harbor accumulations or residual asbestos dust shall be checked after vacuuming to verify that no asbestos-containing material remains; and shall be re-vacuumed as necessary to remove the ACM.

3.6.9 Abatement of Asbestos Contaminated Soil

This paragraph is only applicable in case of accidental spillage by the Contractor. Asbestos contaminated soil shall be removed from areas to a minimum depth of 2 inches. Soil shall be thoroughly dampened with amended water and then removed by manual shoveling into labeled containers. The workers shall be closely monitored for heat exhaustion. The minimum ventilation shall be 8 air changes per hour through a local exhaust HEPA system.

3.6.10 Sealing Contaminated Items Designated for Disposal

Contaminated architectural appurtenances designated for removal and items in the building that are contaminated by the Contractor during execution of work shall be coated with an asbestos lockdown encapsulant at the demolition site before being removed from the asbestos control area. These items shall not be vacuumed prior to application of the lockdown encapsulant. The asbestos lockdown encapsulant shall be tinted a contrasting color and shall be spray applied by airless method. Thoroughness of sealing operation shall be visually gauged by the extent of colored coating on exposed surfaces.

3.7 FINAL CLEANING AND VISUAL INSPECTION

Upon completion of abatement, the regulated area shall be cleaned by collecting, packing, and storing all gross contamination. A final cleaning shall be performed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the cleaning, the Contractor shall conduct a visual pre-inspection of the cleaned area in preparation for a final inspection and final air clearance monitoring. Upon completion of the final cleaning, the Contractor and the Contracting

Officer shall conduct a final visual inspection of the cleaned regulated area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection. If the Contracting Officer rejects the clean regulated area as not meeting final cleaning requirements, the Contractor shall reclean as necessary and have a follow-on inspection conducted with the Contracting Officer. Recleaning and follow-up reinspection shall be at the Contractor's expense.

3.8 LOCKDOWN

Prior to removal of plastic barriers and after clean-up of gross contamination and final visual inspection, a post removal (lockdown) encapsulant shall be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.9 EXPOSURE ASSESSMENT AND AIR MONITORING

3.9.1 General Requirements For Exposure

Exposure assessment, air monitoring and analysis of airborne concentration of asbestos fibers shall be performed in accordance with 29 CFR 1926, Section .1101, the Contractor's air monitoring plan, and as specified. Personal exposure air monitoring (collected at the breathing zone) that is representative of the exposure of each employee who is assigned to work within a regulated area shall be performed by the Contractor's IHT. Breathing zone samples shall be taken for at least 25 percent of the workers in each shift, or a minimum of 2, whichever is greater. Air monitoring results at the 95 percent confidence level shall be calculated as shown in Table 2 at the end of this section. Preabatement and abatement environmental air monitoring shall be performed by the Contractor's IHT, under the direction of the Designated IH. Final clearance environmental air monitoring, shall be performed by the Contractor's Designated IHT. Environmental and final clearance air monitoring shall be performed using NIOSH Pub No. 84-100 Method 7400 (PCM) with optional confirmation of results by NIOSH Pub No. 84-100 Method 7402 (TEM). For environmental and final clearance, air monitoring shall be conducted at a sufficient velocity and duration to establish the limit of detection of the method used at 0.005 f/cc. Confirmation of asbestos fiber concentrations (asbestos f/cc) from environmental and final clearance samples collected and analyzed by NIOSH Pub No. 84-100 Method 7400 (total f/cc) may be conducted using TEM in accordance with NIOSH Pub No. 84-100 Method 7402. When such confirmation is conducted, it shall be from the same sample filter used for the NIOSH Pub No. 84-100 Method 7400 PCM analysis. For all Contractor required environmental or final clearance air monitoring, confirmation of asbestos fiber concentrations, using NIOSH Pub No. 84-100 Method 7402, shall be at the Contractor's expense. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. Results of breathing zone samples shall be posted at the job site and made available to the COR. The Contractor shall maintain a fiber concentration inside a regulated area less than or equal to 0.1 f/cc expressed as an 8 hour, time-weighted average (TWA) during the conduct of the asbestos abatement. If fiber concentration rises above 0.1 f/cc, work procedures shall be investigated with the COR to determine the cause. At the discretion of the COR, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. The Contractor's workers shall not be exposed to an airborne fiber concentration in excess of 1.0 f/cc, as averaged over a sampling period of 30 minutes. Should either an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA or a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur

inside a regulated work area, the Contractor shall stop work immediately, notify the COR, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the COR.

3.9.2 Initial Exposure Assessment

The Contractor's IHT shall conduct an exposure assessment immediately before or at the initiation of an asbestos abatement operation to ascertain expected exposures during that operation. The assessment shall be completed in time to comply with the requirements which are triggered by exposure data or the lack of a negative exposure assessment, and to provide information necessary to assure that all control systems planned are appropriate for that operation. The assessment shall take into consideration both the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the Contractor which indicate the levels of airborne asbestos likely to be encountered on the job. If Class I asbestos work is required, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in excess of PELs, or otherwise makes a negative exposure assessment, the Contractor shall presume that employees are exposed in excess of the PEL-TWA and PEL-Excursion Limit.

3.9.3 Negative Exposure Assessment

The Contractor shall provide a negative exposure assessment for the specific asbestos job which will be performed. The negative exposure assessment shall be provided within 1 day of the initiation of the project and conform to the following criteria:

- a. **Objective Data:** Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the PEL-TWA and PEL-Excursion Limit under those work conditions having the greatest potential for releasing asbestos.
- b. **Prior Asbestos Jobs:** Where the Contractor has monitored prior asbestos jobs for the PEL and the PEL-Excursion Limit within 12 months of the current job, the monitoring and analysis were performed in compliance with asbestos standard in effect; the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the Contractor's current operations; the operations were conducted by employees whose training and experience are no more extensive than that of employees performing the current job; and these data show that under the conditions prevailing and which will prevail in the current workplace, there is a high degree of certainty that the monitoring covered exposure from employee exposures will not exceed the PEL-TWA and PEL-Excursion Limit.
- c. **Initial Exposure Monitoring:** The results of initial exposure monitoring of the current job, made from breathing zone air samples that are representative of the 8-hour PEL-TWA and 30-minute short-term exposures of each employee. The monitoring

covered exposure from operations which are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

3.9.4 Preabatement Environmental Air Monitoring

Preabatement environmental air monitoring shall be established 1 day prior to the masking and sealing operations for each regulated area to determine background concentrations before abatement work begins. As a minimum, preabatement air samples shall be collected using NIOSH Pub No. 84-100 Method 7400, PCM at these locations: (1) outside the building; (2) inside the building, but outside the regulated area perimeter; and (3) inside each regulated work area. One sample shall be collected for every 2000 square feet of floor space. At least 2 samples shall be collected outside the building: at the exhaust of the HEPA unit; and downwind from the abatement site. The PCM samples shall be analyzed within 24 hours; and if any result in fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using NIOSH Pub No. 84-100 Method 7402 (TEM).

3.9.5 Environmental Air Monitoring During Abatement

Until an exposure assessment is provided to the COR, environmental air monitoring shall be conducted at locations and frequencies that will accurately characterize any evolving airborne asbestos fiber concentrations. The assessment shall demonstrate that the product or material containing asbestos minerals, or the abatement involving such product or material, cannot release airborne asbestos fibers in concentrations exceeding 0.01 f/cc as a TWA under those work conditions having the greatest potential for releasing asbestos. The monitoring shall be at least once per shift at locations including, but not limited to, close to the work inside a regulated area; preabatement sampling locations; outside entrances to a regulated area; close to glovebag operations (if applicable); representative locations outside of the perimeter of a regulated area; inside clean room; and at the exhaust discharge point of local exhaust system ducted to the outside of a containment (if used). If the sampling outside regulated area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, work shall be stopped immediately, and the COR notified. The condition causing the increase shall be corrected. Work shall not restart until authorized by the COR.

3.9.6 Final Clearance Air Monitoring

Prior to conducting final clearance air monitoring, the Contractor and the COR shall conduct a final visual inspection of the regulated area where asbestos abatement has been completed. The final visual inspection shall be as appended herein. Final clearance air monitoring shall not begin until acceptance of the Contractor's final cleaning by the COR. The Contractor's IHT shall conduct final clearance air monitoring using aggressive air sampling techniques as defined in EPA 560/5-85-024 or as otherwise required by federal or state requirements. The sampling and analytical method used will be NIOSH Pub No. 84-100 Method 7400 (PCM) and Table 3 with confirmation of results by NIOSH Pub No. 84-100 Method 7402 (TEM).

3.9.6.1 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH Pub No. 84-100 Method 7400, the fiber concentration inside the abated regulated area, for each airborne

sample, shall be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) shall be confirmed from that same filter using NIOSH Pub No. 84-100 Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning shall be repeated.

Upon completion of any required recleaning, resampling with results to meet the above clearance criteria shall be done.

3.9.6.2 Air Clearance Failure

If clearance sampling results fail to meet the final clearance requirements, the Contractor shall pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

3.9.7 Air-Monitoring Results and Documentation

Air sample fiber counting shall be completed and results provided within 24 hours (breathing zone samples), and 24 hours (environmental/clearance monitoring) after completion of a sampling period. The Contracting Officer shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing laboratory principal and the Contractor's IHT and Designated CIH. The air sampling results shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample:

- a. Sampling and analytical method used;
- b. Date sample collected;
- c. Sample number;
- d. Sample type: BZ = Breathing Zone (Personal), P = Preabatement, E = Environmental, C = Abatement Clearance;
- e. Location/activity/name where sample collected;
- f. Sampling pump manufacturer, model and serial number, beginning flow rate, end flow rate, average flow rate (L/min);
- g. Calibration date, time, method, location, name of calibrator, signature;
- h. Sample period (start time, stop time, elapsed time (minutes));
- i. Total air volume sampled (liters);
- j. Sample results (f/cc) for final clearance;
- k. Laboratory name, location, analytical method, analyst, confidence level. In addition, the printed name and a signature and date block for the IHT who conducted the sampling and for the CIH who reviewed the daily air monitoring log verifying the accuracy of the information.

3.10 CLEARANCE CERTIFICATION

When asbestos abatement is complete, ACM waste is removed from the regulated areas, and final clean-up is completed, the COR will certify the areas as safe before allowing the warning signs and boundary warning tape to be removed. After final clean-up and acceptable airborne concentrations are attained, but before the HEPA unit is turned off and the containment removed, the Contractor shall remove all pre-filters on the building HVAC system and provide new pre-filters. The Contractor shall dispose of such filters as asbestos contaminated materials. HVAC, mechanical, and electrical systems shall be re-established in proper working order. The Contractor and the COR shall visually inspect all surfaces (within the containment, if applicable) for residual material or accumulated debris. The Contractor shall reclean all areas showing dust or residual materials. The Contracting Officer will certify in writing that the area is safe before unrestricted entry is permitted. The Government will have the option to perform monitoring to certify the areas are cleaned.

3.11 CLEANUP AND DISPOSAL

3.11.1 Title to ACM Materials

ACM material resulting from abatement work, except as specified otherwise, shall be disposed of by the Contractor as specified and in accordance with applicable federal, state and local regulations.

3.11.2 Collection and Disposal of Asbestos

All ACM waste shall be collected and including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing, shall be collected and placed in leak-tight containers such as double plastic bags; sealed double wrapped polyethylene sheet; sealed fiberboard boxes; or other approved containers. Waste within the containers shall be wetted in case the container is breached. Asbestos-containing waste shall be disposed of [AM#2] in Fort Hood sanitary landfill [AM#2] in accordance with Section 01368 Special Project Procedures for Ft. Hood. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the Contracting Officer. Procedure for hauling and disposal shall comply with 40 CFR 61, Subpart M, state, regional, and local standards.

3.11.3 Scale Weight Measurement

Scales used for measurement shall be public scales. Weighing shall be at a point nearest the work at which a public scale is available. Scales shall be standard truck scales of the beam type; scales shall be equipped with the type registering beam and an "over and under" indicator; and shall be capable of accommodating the entire vehicle. Scales shall be tested, approved and sealed by an inspector of the State of Texas. Scales shall be calibrated and resealed as often as necessary and at least once every three months to ensure continuous accuracy. Vehicles used for hauling ACM shall be weighed empty daily at such time as directed and each vehicle shall bear a plainly legible identification mark.

3.11.4 Weigh Bill and Delivery Tickets

Copies of weigh bills and delivery tickets shall be submitted to the COR during the progress of the work. The Contractor shall furnish the Contracting Officer scale tickets for each load of ACM weighed and certified. These tickets shall include tare weight; identification mark for each vehicle weighed; and date, time and location of loading and unloading. Tickets shall be furnished at the point and time individual trucks arrive at the worksite. A master log of all vehicle loading shall be furnished for each day of loading operations. Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified weigh bills and/or certified tickets and manifests of all ACM actually disposed by the Contractor for this contract.

3.11.5 Asbestos Waste Shipment Record

The Contractor shall complete and provide the COR final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M and other required state waste manifest shipment records, within 3 days of delivery to the landfill. Waste manifest shall be signed by a representative of DPW-Environmental who has signature authority. Each Waste Shipment Record shall be signed and dated by the Contractor, COR, the waste transporter and disposal facility operator.

TABLE 1-A

INDIVIDUAL WORK TASK DATA ELEMENTS

BUILDING 90050 (Fire Station)

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER: 90050-1
2. LOCATION OF WORK TASK: B/90050 Ceiling
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Suspended Sheetrock, Tape and Joint Mud
 - a. Type of Asbestos: Chrysotile
 - b. Percent asbestos content: ranged from 0.75% to 3.0%
4. ABATEMENT TECHNIQUE TO BE USED: REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: Class I
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK: Friable, Category II
7. FORM: IA and CONDITION OF ACM: FAIR
8. QUANTITY: SQUARE METERS: 10 (Approx.)

NOTES:

- (1) Numeric sequence of individual work tasks (1,2,3,4, etc.) for each regulated area. Each category of EPA friability/OSHA class has a separate task.
- (2) Specific location of work (building, floor, area, e.g., Building 1421, 2nd Floor, Rm 201)
- (3) A description of material to be abated (example: horizontal pipe, cement wall panels, tile, stucco, etc.) type of asbestos (chrysotile, amosite, crocidolite, etc.); and % asbestos content.
- (4) Technique to be used: Removal = REM; Encapsulation = ENCAP; Encasement = ENCAS; Enclosure = ENCL; Repair = REP.
- (5) Class designation: Class I, II, III, or IV (OSHA designation).
- (6) Friability of materials: Check the applicable EPA NESHAP friability designation.
- (7) Form: Interior or Exterior Architectural = IA or EA; Mechanical/Electrical = ME.
Condition: Good = G; Fair = F; Poor = P.
- (8) Quantity of ACM for each work task in meters or square meters.

TABLE 1-B
INDIVIDUAL WORK TASK DATA ELEMENTS
BUILDING 90050 (Fire Station)

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER: 90050-2
2. LOCATION OF WORK TASK: Restroom pipe chase, behind wall
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Pipe insulation on less than 4-inch diameter pipe.
 - a. Type of Asbestos: Presumed asbestos containing material
 - b. Percent asbestos content: access problem, no sample collected
4. ABATEMENT TECHNIQUE TO BE USED: REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: CLASS I
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK: friable, Category II
7. FORM: IA and CONDITION OF ACM: PACM, no information
8. QUANTITY: 20 METERS (Approx.)

TABLE 1-C

INDIVIDUAL WORK TASK DATA ELEMENTS

BUILDING 90049 (Control Tower & Ops Bldg)

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER: 90049-1
2. LOCATION OF WORK TASK: Mechanical Room, Basement and 7th Floor (Tower)
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Flexible Connector
 - a. Type of Asbestos: Chrysotile
 - b. Percent asbestos content: ranged from 7% to 50%
4. ABATEMENT TECHNIQUE TO BE USED: REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: CLASS II
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK: Non-friable, Category II
7. FORM: IA and CONDITION OF ACM: GOOD
8. QUANTITY: 2.1 SQUARE METERS (Approx.); 6 each (in Basement) and 4 each (on 7th Floor).

TABLE 1-D

INDIVIDUAL WORK TASK DATA ELEMENTS

BUILDING 90049 (Control Tower & Ops Bldg)

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER: 90049-2
2. LOCATION OF WORK TASK: ENTIRE BUILDING
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: 12-inch by 12-inch Floor Tile and Mastic lay on top of 9-inch by 9-inch Floor Tile and mastic
 - a. Type of Asbestos: Floor Tile (non-detect for asbestos); Mastic has Chrysotile
 - b. Percent asbestos content: ranged from 5% to 7%, mastic
4. ABATEMENT TECHNIQUE TO BE USED: REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: CLASS II
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK: Non-friable, Category I
7. FORM: IA and CONDITION OF ACM: GOOD
8. QUANTITY: 1875 SQUARE FEET (Approx., including both tile and mastic)

Remarks: Floor tile is not removed with the building structures because it is contaminated by the 9" by 9" floor tile and mastic (in poor condition).

TABLE 1-E

INDIVIDUAL WORK TASK DATA ELEMENTS

BUILDING 90049 (Control Tower & Ops Bldg)

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER: 90049-3
2. LOCATION OF WORK TASK: ENTIRE BUILDING
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: 9-inch by 9-inch Floor Tile and Mastic covered by 12-inch by 12-inch Floor Tile and mastic
 - a. Type of Asbestos: Chrysotile
 - b. Percent asbestos content: Tile and Mastic both contain 5%
4. ABATEMENT TECHNIQUE TO BE USED: REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: CLASS II
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK: Non-friable, Category I
7. FORM: IA and CONDITION OF ACM: POOR
8. QUANTITY: 1875 SQUARE FEET (Approx., including both tile and mastic)

TABLE I-F

INDIVIDUAL WORK TASK DATA ELEMENTS

BUILDING 90049 (Control Tower & Ops Bldg)

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER: 90049-4
2. LOCATION OF WORK TASK: Window Casing at Mechanical Room, Basement
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Window caulking
 - a. Type of Asbestos: Chrysotile
 - b. Percent asbestos content: 3%
4. ABATEMENT TECHNIQUE TO BE USED: REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: CLASS II
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK: Non-friable,
Category II
7. FORM: IA and CONDITION OF ACM: FAIR
8. QUANTITY: 1.2 SQUARE METER (Approx.)

TABLE 1-G

INDIVIDUAL WORK TASK DATA ELEMENTS

BUILDING 90049 (Control Tower & Ops Bldg)

There is a separate data sheet for each individual work task.

1. WORK TASK DESIGNATION NUMBER: 90049-5
2. LOCATION OF WORK TASK: Mechanical Room, 6th Floor (Tower)
3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: 4-inch diameter pipe
canvas wrap with powder insulation
 - a. Type and Percent of Asbestos: Chrysotile (15%) and Amosite
(25%)
4. ABATEMENT TECHNIQUE TO BE USED: REM
5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK: CLASS I
6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK: friable,
Category II
7. FORM: IA and CONDITION OF ACM: GOOD
8. QUANTITY: 12 METER (Approx.)

TABLE 2

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL
(Reference: NIOSH 7400)

$$\text{Fibers/cc(01.95 percent CL)} = X + (X) * (1.645) * (CV)$$

Where: $X = ((E)(AC))/((V)(1000))$

$$E = ((F/Nf) - (B/Nb))/Af$$

CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the Contracting Officer with documentation (Round Robin Program participation and results) that the laboratory's precision is better.

AC = Effective collection area of the filter in square millimeters

V = Air volume sampled in liters

E = Fiber density on the filter in fibers per square millimeter

F/Nf = Total fiber count per graticule field

B/Nb = Mean field blank count per graticule field

Af = Graticule field area in square millimeters

$$TWA = C1/T1 + C2/T2 = Cn/Tn$$

Where: C = Concentration of contaminant

T = Time sampled.

TABLE 3

NIOSH METHOD 7400

PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Note 2) (Liters)	Sampling Rate (liters/min.)
Inside Abatement Area	0.5/140 Square Meters (Notes 3 & 4)	0.45 microns	3850	2-16
Each Room in 1 Abatement Area Less than 140 Square meters		0.45 microns	3850	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.
2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.
3. One sample shall be added for each additional 140 square meters. (The corresponding I-P units are 5/1500 square feet).
4. A minimum of 5 samples are to be taken per abatement area, plus 2 field blanks.

TABLE 4

CERTIFICATION OF FINAL CLEANING AND VISUAL INSPECTION

A separate inspection shall be applicable to each abatement work task. In accordance with the cleaning and decontamination procedures specified in the Contractor's Asbestos Hazard Abatement Plan and this contract. The Contractor hereby certifies that he/she has thoroughly visually inspected the decontaminated regulated area (all surfaces, including pipes, beams, ledges, wall, ceiling, floor, decontamination units, etc.) In accordance with ASTM E1368, Standard Practice for Visual Inspection of Asbestos Abatement Projects, has found no dust, or asbestos-containing material residue.

Contractor's Signature:

Date:

Print Name and Title:

Contractor's On-site Supervisor's Signature:

Print Name and Title:

Contractor's Designated CIH's Signature:

Print Name and Title:

Contractor's IHT's Signature:

Print Name and Title:

CONTRACTING OFFICER REPRESENTATIVE (COR) ACCEPTANCE OR REJECTION

I hereby determine that the Contractor has performed final cleaning and visual inspection of the decontaminated regulated work area (all surfaces including beams, ledges, wall, ceiling, floor, decontamination units, etc.) And by quality assurance inspection, find the Contractor's final cleaning to be:

_____Acceptable

_____Unacceptable, Contractor instructed to reclean the regulated area

COR's Signature:

Date:

Print Name and Title:

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME _____ CONTRACT NO. _____
PROJECT ADDRESS _____
CONTRACTOR FIRM NAME _____
EMPLOYEE'S NAME _____, _____, _____,
(Print) (Last) (First) (MI)

Social Security Number: _____-_____-_____,

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that you be provided and you complete formal asbestos training specific to the type of work you will perform and project specific training; that you be supplied with proper personal protective equipment including a respirator, that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you. The Contractor's Designated Industrial Hygienist will check the block(s) for the type of formal training you have completed. Review the checked blocks prior to signing this certification.

FORMAL TRAINING:

_____ a. For Competent Persons and Supervisors: I have completed EPA's Model Accreditation Program (MAP) training course, "Contractor/Supervisor", that meets this State's requirements.

_____ b. For Workers:

_____ (1) For OSHA Class I work: I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (2) For OSHA Class II work (where there will be abatement of more than one type of Class II materials, i.e., roofing, siding, floor tile, etc.): I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (3) For OSHA Class II work (there will only be abatement of one type of Class II material):
_____ (a) I have completed an 8-hour training class on the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls of 29 CFR 1926, Section .1101(g) and hands-on training.

_____ (b) I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (4) For OSHA Class III work: I have completed at least a 16-hour course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, Section .92(a)(2) and the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926, Section .1101, and hands-on training.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

_____ (5) For OSHA Class IV work: I have completed at least a 2-hr course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, (a)(1), and the elements of 29 CFR 1926, Section .1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926, Section .1101(g) and hands-on training.

_____ c. Workers, Supervisors and the Designated Competent Person: I have completed annual refresher training as required by EPA's MAP that meets this State's requirements.

PROJECT SPECIFIC TRAINING:

_____ I have been provided and have completed the project specific training required by this Contract. My employer's Designated Industrial Hygienist and Designated Competent Person conducted the training.

RESPIRATORY PROTECTION:

_____ I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair and contact lens use policy of my employer.

RESPIRATOR FIT-TEST TRAINING:

_____ I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time.

MEDICAL EXAMINATION:

_____ I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's Industrial Hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

_____ were no limitations to performing the required work tasks.

_____ were identified physical limitations to performing the required work tasks.

Date of the medical examination _____

Employee Signature _____ date _____

Contractor's Industrial

Hygienist Signature _____ date _____

-- End of Section --

BASE BID

QUEST

MicroAnalytics, Inc.

2530 Electronic Lane, Suite 712

Dallas, Texas 75220-1229

214.351.4441 Fax 214.351.4487

PLM REPORT

NVLAP Lab No. 200249

TDH License No. 30-0218

Client: U.S. Army Corps of Engineers

Request No.: 003847

Project: Fixed Wing Aircraft, Ft. Hood Building 90079

Date: 11/23/99

Project No.: 93190877

Sample Date: 11/17/99

Identification: Polarized Light Microscopy/Dispersion Staining (PLM/DS)

Test Method: Method 40 CFR, Ch. 1, Part 763, Subpart F, Appendix A

On 11/19/99, fifteen (15) bulk samples were submitted by Kathleen Wu of the U.S. Army Corps of Engineers for PLM/DS asbestos analysis. The results are outlined below:

Client No.	Lab No.	Sample Description	Fibrous Components	Asbestos Content
90079-A01	9-14097	Tan Putty around Door Frame	None	None Detected
90079-A02	9-14098	White Putty between CMU Joints	2% Cellulose	None Detected
90079-A03	9-14099	12"x12" Brown Speckled Floor Tile (A) with Black Mastic (B)	None	A) None Detected B) 5% Chrysotile
90079-A04	9-14100	Beige Putty around Door Frame	3% Wollastonite	None Detected
90079-A05	9-14101	Sheetrock, Joint Compound, Tape	NA	<0.25% Chrysotile by Point Count
90079-A06	9-14102	Sheetrock, Joint Compound, Tape	NA	<0.25% Chrysotile by Point Count
90079-A07	9-14103	Grey Putty around Window	None	None Detected
90079-A08	9-14104	White Putty around Door	2% Cellulose	None Detected
90079-A09	9-14105	Beige Vinyl Baseboard (A) with Tan Mastic (B)	None	A) None Detected B) None Detected
90079-A10	9-14106	Rolled Roofing (A), Felt Paper (B) and Black Tar (C), Main Building	A) 20% Fiberglass B) 35% Fiberglass	A) None Detected B) None Detected C) None Detected
90079-A11	9-14107	Rolled Roofing (A), Felt Paper (B) and Black Tar (C), Control Tower	A) 25% Fiberglass B) 40% Fiberglass	A) None Detected B) None Detected C) None Detected
90079-A12	9-14108	Black Tar around Vent	None	20% Chrysotile
90079-A13	9-14109	12"x12" Brown Speckled Beige Floor Tile (A) with Black Mastic (B)	None	A) None Detected B) 5% Chrysotile
90079-A14	9-14110	12"x12" Brown Speckled Beige Floor Tile (A) with Black Mastic (B)	None	A) None Detected B) 5% Chrysotile
90079-A15	9-14111	Laminate Counter Top with Clear Coating on Wood	70% Cellulose	None Detected

The EPA test method for bulk analysis (EPA/600/R-93/116) states in paragraph 2.2.2 that "the detection limit for visual estimation is a function of the quantity of the sample analyzed, the nature of the matrix interference, sample preparation, and fiber size and distribution. Asbestos may be detected in concentrations of less than one percent by area if sufficient material is analyzed. Samples may contain fibers too small to be resolved by PLM (<0.25 micrometers in diameter) so detection of those fibers by this method may not be possible."

Samples are analyzed by layers, and percentages estimated visually during microscopic examination. Samples will be archived for a minimum of 90 days following analysis, and individual analysis sheets are available upon request. Results may not be reproduced except in full. This test report relates only to the samples tested, and results must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Analyst: Jennifer Jaber

Lab Director: Jennifer Jaber

Approved Signatory: *Jennifer Jaber*



CHAIN OF CUSTODY RECORD

Lab. PR&C No.: 93190877 Proj Mngr: Poy Har Kathleen Wu Phone No: 817/978-3977 ext1645		Proj/Instal'n: Fixed Wing Aircraft Park, Bldg. 90079, 90080, 90071 Electronic Data Format: Use .pdf		Site/Feature: Ft. Hood FEDEX Acct. No.: 1128-3856-2	
Analytes/Test Methods					
Turn-around Time in Days					
PLM	EPA 600/R-93/116	3-5			
PLM-Point Count	EPA 600/R-93/116	3-5			
Total Lead (mg/Kg)	EPA 6010	6-10			
TCLP lead (mg/l)	EPA 1311/6010	10			
NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable					
Date	Field Sample No./Description	Matrix			
11/17/99	90079-A01 Putty around Door Frame	Solid			X
11/17/99	90079-A02 Putty between Caul joints	Solid			X
11/17/99	90079-A03 Floor Tile 12" X 12"	Solid			X
	Beige w/ Brown Specks, Black Mastic	Solid			
11/17/99	90079-A04 Putty around Door frame	Solid			X
11/17/99	90079-A05 Sheetrock, Joint Compound, Tape	Solid			X
11/17/99	90079-A06 Sheetrock, Joint Compound, Tape	Solid			X
11/17/99	90079-A07 Putty around Window	Solid			X
11/17/99	90079-A08 Putty around Door	Solid			X
Relinquished by:	J. Haro	Received by:	Cheryl Gahan	Date/Time:	11/19/99
Relinquished by:		Received by:		Date/Time:	
Relinquished by:		Received for lab by:		Date/Time:	

9-14097

4:50 pm

003847

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

Lab. PR&C No.: 9319087
 Proj Mngr: Poy Har Kathleen Wu
 Phone No: 817/978-3977 ext1645

Analytes/Test Methods

PLM	EPA 600/R-93/116	3-5
PLM-Point Count	EPA 600/R-93/116	3-5
Total Lead (mg/Kg)	EPA 6010	6-10
TCLP lead (mg/l)	EPA 1311/6010	10

NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable

Date	Field Sample No./Description	Matrix
"11/17/99	90079-A09 Vinyl Baseboard Tan Mastic	Solid
"11/17/99	90079-A10 Rolled Roofing, Felt Paper	Solid
	Black Tar - Main Bldg.	
"11/17/99	90079-A11 Rolled Roofing, Felt Paper	Solid
	Black Tar - Control Tower	
"11/17/99	90079-A12 Black Tar around Vent	Solid
"11/17/99	90079-A13 12"X12" Floor Tile w/ Brown	Solid
	Specks + Black Mastic	

4:50pm

Relinquished by: <i>J. Land</i>	Date/Time: 11-18-99	Received by: <i>Cynthia Smith</i>	Date/Time: 11/19/99
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received for lab by:	Date/Time:

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

Q-14111

4:50am

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

QUEST

MicroAnalytics, Inc.

2530 Electronic Lane, Suite 712

Dallas, Texas 75220-1229

214.351.4441 Fax 214.351.4487

PLM REPORT

NVLAP Lab No. 200249

TDH License No. 30-0218

Client: U.S. Army Corps of Engineers

Request No.: 003849

Project: Fixed Wing Aircraft, Ft. Hood Building 90080

Date: 11/23/99

Project No.: 93190877

Sample Date: 11/16/99

Identification: Polarized Light Microscopy/Dispersion Staining (PLM/DS)

Test Method: Method 40 CFR, Ch. 1, Part 763, Subpart F, Appendix A

On 11/19/99, five (5) bulk samples were submitted by Kathleen Wu of the U.S. Army Corps of Engineers for PLM/DS asbestos analysis. The results are outlined below:

Client No.	Lab No.	Sample Description	Fibrous Components	Asbestos Content
90080-A01	9-14112	Paint, Tape and Joint Compound	NA	0.00% Asbestos by Point Count
90080-A02	9-14113	Paint, Tape and Joint Compound	NA	0.00% Asbestos by Point Count
90080-A03	9-14114	12"x12" Brown Speckled Beige Floor Tile (A) with Tan Mastic (B)	B) 5% Cellulose	A) None Detected B) None Detected
90080-A04	9-14115	12"x12" Brown Speckled Beige Floor Tile (A) with Tan Mastic (B)	B) 5% Cellulose	A) None Detected B) None Detected
90080-A05	9-14116	Grey Vinyl Baseboard (A) with Tan Mastic (B)	None	A) None Detected B) None Detected

The EPA test method for bulk analysis (EPA/600/R-93/116) states in paragraph 2.2.2 that "the detection limit for visual estimation is a function of the quantity of the sample analyzed, the nature of the matrix interference, sample preparation, and fiber size and distribution. Asbestos may be detected in concentrations of less than one percent by area if sufficient material is analyzed. Samples may contain fibers too small to be resolved by PLM (<0.25 micrometers in diameter) so detection of those fibers by this method may not be possible."

Samples are analyzed by layers, and percentages estimated visually during microscopic examination. Samples will be archived for a minimum of 90 days following analysis, and individual analysis sheets are available upon request. Results may not be reproduced except in full. This test report relates only to the samples tested, and results must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Analyst: Jennifer Jaber

Lab Director: Jennifer Jaber

Approved Signatory: *Jennifer Jaber*

NVLAP

CHAIN OF CUSTODY RECORD

Lab. PROC No.: 893190877 Proj/Instal'n: Fixed Wing Aircraft Site/Feature: Ft. Hood
 Proj Mngr: Poy Har Kathleen Wu Park, Bldg. 90079, 90080, 90071
 Phone No: 817/978-3977 ext1645 Electronic Data Format: Use .pdf FEDEX Acct. No.: 1128-3856-2

Analytes/Test Methods Turn-around Time in Days

PLM EPA 600/R-93/116 3-5

PLM-Point Count EPA 600/R-93/116 3-5

Total Lead (mg/Kg) EPA 6010 6-10

TCLP lead (mg/l) EPA 1311/6010 10

NOTE: Report Friability of asbestos in PLM REPORT - on column
 "Description" By NF = nonfriable and F = friable

Date	Field Sample No./Description	Matrix
11/16/99	90080-A01-Paint, Tape, Joint Compound	Solid
11/16/99	90080-A02 Paint, Tape, Joint Compound	Solid
11/16/99	90080-A03 12"X12" BEIGE w/brown	Solid
	Specks - Floor Tile Tan Mastic	
11/16/99	90080-A04 12"X12" Beige w/brown	Solid
	Specks - Floor Tile Tan Mastic	
11/16/99	90080-A05 Vinyl Baseboard	Solid
	Tan Mastic	

Relinquished by: <u>J. Har</u>	Date/Time: <u>11-18-99</u>	Received by: <u>D. Miller</u>	Date/Time: <u>11/19/99</u>
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received for lab by:	Date/Time:

9-14-112

9-14-116

4:50pm

003843

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

BID OPTION NO. 1

QUEST

MicroAnalytics, Inc.

2530 Electronic Lane, Suite 712

Dallas, Texas 75220-1229

Tel 214.351.4441 Fax 214.351.4487

POINT COUNT REPORT

NVLAP Lab No. 200249

TDH License No. 30-0218

Client: U.S. Army Corps of Engineers

Project: Fort Hood Building 90050

Project No. Fixed Wing Aircraft Park

Identification: Asbestos Bulk Sample Analysis

Test Method: Polarized Light Microscopy/Dispersion Staining(PLM/DS)/
Point Count EPA Method 600/R-93/116

Request No.: 002884

Report Date : 5/3/99

Sample Date: 4/13/99

On 4/27/99, 16 bulk samples were submitted b Jack Cronkrite of the USACE

for Point Count analysis.

Copies of the lab data sheets are attached. The results are summarized below:

Client No	Lab No	Sample Description	Asbestos Content
A01	9-04474	White Texture on Sheetrock	0.00% Asbestos
A02	9-04475	White Texture on Sheetrock	0.00% Asbestos
A03	9-04476	White Texture on Sheetrock	0.00% Asbestos
A04	9-04477	Beige Texture on Ceiling Sheetrock	0.75% Chrysotile
A05	9-04478	2'x4' Drop Ceiling Tile	0.00% Asbestos
A06	9-04479	White Ceiling Texture on Sheetrock	0.00% Asbestos
A07	9-04480	White Caulking, Bathroom Sink	0.00% Asbestos
A08	9-04481	Old Ceiling Tile with Paint	0.00% Asbestos
A09	9-04482	Brown Floor Tile with Mastic	0.00% Asbestos
A10	9-04483	Brown Laminate Kitchen Top with Mastic	0.00% Asbestos
A11	9-04484	Beige Flexible Joint, Kitchen Heater	0.00% Asbestos
A12	9-04485	White Window Caulking, Kitchen	0.00% Asbestos
A13	9-04486	Black Caulk Concrete Expansion Joint	0.00% Asbestos
A14	9-04487	Tar Paper outside Wood Wall	0.00% Asbestos

A15	9-04488	Black Roll Roofing	0.00% Asbestos
A16	9-04489	Black Roofing Tar	0.25% Chrysotile

Asbestos percentage determined by point count.

The asbestos content should be considered when establishing policy regarding these bulk materials. Results may not be reproduced except in full. This test report relates only to the samples tested, and must not be used to imply endorsement by NVLAP or any agency of the U.S. Government.

Analyst: Jennifer Jaber

Lab Director: Jennifer D. Jaber

Approved Signatory

Jennifer Jaber

NVLAP

CHAIN OF CUSTODY RECORD

Lab. PRC No.: 90989507
 Proj. Mgr: Poy Har Kathleen Wu
 Phone No: 817/978-3977 ext 1645

Proj/Instal'n: Fixed Wing Aircraft
 Park, Bldg. 90050
 Electronic Data Format: Yes

Site/Feature: Ft. Hood
 FEDEX Acct. No.: 1128-3856-2

Analytes/Test Methods	Turn-around Time in Days
PLM EPA 600/R-93/116	3-5
PLM-Point Count EPA 600/R-93/116	3-5
Total Lead (mg/Kg) EPA 6010	6-10
TCLP lead (mg/l) EPA 1311/6010	10

NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable

Date	Field Sample No./Description	Matrix
13 Apr 99	90050-A01 Wallboard, Sheetrock, mud & Tape	PACM
13 Apr 99	90050-A02 Wallboard, Sheetrock, mud & Tape	PACM
13 Apr 99	90050-A03 Wallboard, Sheetrock, mud & Tape	PACM
13 Apr 99	90050-A04 Ceiling, Sheetrock, mud & Tape	PACM
13 Apr 99	90050-A05 Drop Ceiling, 2'x4' Tiles	PACM
13 Apr 99	90050-A06 Ceiling Sheetrock, Texture & Paint	PACM
14 Apr 99	90050-A07 Caulking, Bathroom Sink	PACM
14 Apr 99	90050-A08 Ceiling tile with Paint	PACM
14 Apr 99	90050-A09 Floor tile, with mastic, white Bruli	PACM

Relinquished by: <i>[Signature]</i>	Received by: <i>[Signature]</i>	Date/Time: 4/27/99 10:15am
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received for lab by:	Date/Time:

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

002884

CHAIN OF CUSTODY RECORD

Lab. PR&C No.: 90899507
 Proj Mgr: Poy Har Kathleen Wu
 Phone No: 817/978-3977 ext 1645

Proj/Instal'n: Fixed Wing Aircraft
 Park, Bldg. 90050
 Electronic Data Format: Yes

Site/Feature: Ft. Hood
 FEDEX Acct. No.: 1128-3856-2

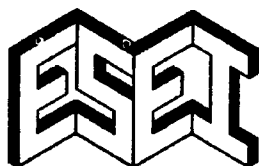
Analytes/Test Methods	Turn-around Time in Days
PLM EPA 600/R-93/116	3-5
PLM-Point Count EPA 600/R-93/116	3-5
Total Lead (mg/Kg) EPA 6010	6-10
TCLP lead (mg/l) EPA 1311/6010	10

NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable

Date	Field Sample No./Description	Matrix
14 Apr 99	90050-A10, laminat Kitchen top/mastic	PACM
14 Apr 99	90050-A11, Flexible joint Kitchen heater	PACM
14 Apr 99	90050-A12, windows caulking Kitchen	PACM
14 Apr 99	90050-A13, Concrete Expansion joint Caulk Between	PACM
14 Apr 99	90050-A14 TAR Paper outside Wood Wall	PACM
14 Apr 99	90050-A15 Roll roofing	PACM
14 Apr 99	90050-A16, Roofing TAR and Giber	PACM
14 Apr 99	90050-L01 Building Material	PACM
14 Apr 99	90050-L02, Wood, Paint, Gray Brown	PACM

Relinquished by: <i>[Signature]</i>	Date/Time: 4/27/99 10:15am
Relinquished by:	Date/Time:
Relinquished by:	Date/Time:

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT



EcoSystems Environmental, Inc.

Environmental Consulting Services

U.S. ARMY CORPS OF ENGINEERS
819 TAYLOR STREET, ROOM 4 CO4
FORT WORTH, TEXAS 76102-0300

PLM BULK ASBESTOS ANALYSIS (NVLAP NO. 101162, TDH LAB LICENSE NO. 30-0117)

POINT COUNTING PROCEDURE

5/18/1999

PROJECT: FIXED WING AIRCRAFT, BLDG. 90050

PROJECT NO.: 90989507

<u>SAMPLE #</u> <u>/LAB</u>	<u>LOCATION OF</u> <u>SAMPLE/TYPE OF</u> <u>MATERIAL SAMPLED</u>	<u>LAYER(%)</u>	<u>NON-FIBROUS</u> <u>MATERIAL (%)</u>	<u>NON-ASBESTOS</u> <u>FIBROUS</u> <u>MATERIAL (%)</u>	<u>ASBESTOS</u> <u>TYPE (%)</u>
90050-A04 99-27740	CEILING (SHEETROCK LAYER) FRIABLE	A 100	BINDER/ GYPSUM 90 CALCITE 2	CELL. 7 SYNTHETIC 1	NONE DET. 0 TOTAL 0*
90050-A04 99-27740	CEILING (TAPE & BED LAYER) FRIABLE	A 100	BINDER/ CARBONATE 95 QUARTZ 1	CELL. <2	CHRYSTILE 2.5 TOTAL 2.5*
90050-A16 99-27740	ROOFING TAR & FIBER (BLACK) NON-FRIABLE	A 100	BINDER/ BITUMEN 80	FIBER GLASS 15 CELL. <3	CHRYSTILE 2.2 TOTAL 2.2*

* POINT COUNTING PROCEDURE WAS USED IN THE QUANTITATION OF ASBESTOS.

ANALYST: _____

BAKH BARGALI



EcoSystems Environmental, Inc.

Environmental Consulting Services

POINT COUNTING PROCEDURE

POINT COUNTING IS PERFORMED FOR REGULATED ASBESTOS-CONTAINING MATERIALS UPON CLIENT'S REQUEST AS PER REGULATIONS OF "NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS; ASBESTOS NESHAP REVISION; FINAL RULE". THE POINT COUNTING FOR THE QUANTITATION OF ASBESTOS IS CONDUCTED IN ACCORDANCE WITH THE PROCEDURE OUTLINED IN U.S. ENVIRONMENTAL PROTECTION AGENCY: 40 CODE OF FEDERAL REGULATIONS CHAPTER I (1-1-87 EDITION) PART 763, SUB-PART F, APPENDIX A.

AN OCULAR RETICLE (CROSS HAIR) IS USED TO VISUALLY SUPERIMPOSE A POINT OR POINTS ON THE MICROSCOPE FIELD OF VIEW. THE NUMBER OF POINTS POSITIONED DIRECTLY ABOVE EACH KIND OF PARTICLE OR FIBER OF INTEREST ARE RECORDED. ONLY POINTS DIRECTLY OVER ASBESTOS FIBERS OR NON-ASBESTOS MATERIAL ARE SCORED. IF AN ASBESTOS FIBER AND A MATRIX PARTICLE OVERLAP SO THAT A POINT IS SUPERIMPOSED ON THEIR VISUAL INTERSECTION, A POINT IS SCORED FOR BOTH CATEGORIES. POINT COUNTING PROVIDES A DETERMINATION OF THE AREA PERCENT OF ASBESTOS. RELIABLE CONVERSION OF AREA PERCENT TO DRY WEIGHT IS NOT CURRENTLY FEASIBLE.

A TOTAL OF 400 POINTS SUPERIMPOSED ON EITHER ASBESTOS FIBERS OR NON-ASBESTOS MATRIX MATERIAL ARE COUNTED OVER AT LEAST EIGHT DIFFERENT PREPARATIONS OF REPRESENTATIVE SUB-SAMPLES. EIGHT FORCEP SAMPLES ARE EACH MOUNTED SEPARATELY WITH THE APPROPRIATE REFRACTIVE INDEX LIQUID. THE SAMPLES ARE PREPPED IN A WAY THAT THEY ARE UNIFORMLY DISPERSED TO AVOID OVERLAPPING PARTICLES AND TO ALLOW 25-50% EMPTY AREA WITHIN THE FIELDS OF VIEW. 50 NON-EMPTY POINTS ARE COUNTED ON EACH PREPARATION BY USING CHALKY POINT ARRAY IN AT LEAST TWO RANDOMLY SELECTED FIELDS. QUANTITATION IS PERFORMED AT THE MAGNIFICATION OF 100X OF THE POLARIZED LIGHT MICROSCOPE AS THE SAMPLE COMPONENTS CAN BE EASILY DISTINGUISHED.

THE PERCENTAGE OF ASBESTOS IS CALCULATED AS FOLLOWS:

$$\% \text{ OF ASBESTOS} = (A/N)100\%$$

A= NUMBER OF ASBESTOS COUNTS

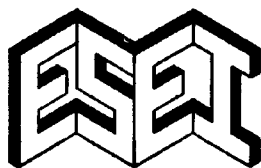
N= NUMBER OF NON-EMPTY POINTS COUNTED

IF A = 0 "NONE DETECTED" WILL BE REPORTED

IF $0 < A < 3$ <1% ASBESTOS WILL BE REPORTED

IF $A > 3$ THE VALUE OF ASBESTOS WOULD BE ROUNDED TO THE NEAREST PERCENT (FOR SAMPLES YIELDING BETWEEN 1 & 2 % OF ASBESTOS THE ACTUAL DECIMAL NUMBER WOULD BE REPORTED).

1408A Vantage Drive • Carrollton, Texas 75006 • (972) 416-0520 • Fax (972) 416-4512



EcoSystems Environmental, Inc.

Environmental Consulting Services

BULK SAMPLE ANALYSES: ASBESTOS

BACKGROUND:

EcoSystems Environmental, Inc. (ESEI) is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) -Laboratory ID # 101162- through the National Institute of Standards and Technology (NIST). ESEI is also licensed and authorized to perform as an asbestos laboratory by the Texas Department of Health (License No. 30-0117). ESEI is a Charter member of North Texas Asbestos Analyst Association's (NTA³) Quality Control Program.

METHOD & LAYERING:

Bulk samples are prepared and analyzed in accordance with the polarized light microscopy procedures outlined in the EPA/600/R-93/116 or the EPA method, under AHERA. The test report relates only to the samples submitted for analysis. ESEI's laboratory accreditation or any of its test results in no way implies product certification, approval, or endorsement by NIST or any agency of the U.S. Government. The test reports can not be reproduced except in full and with ESEI's permission.

When a sample consists of two or more distinct layers or materials, each layer is analyzed and reported separately. Any layer containing more than 1% asbestos is declared by the National Emission Standards for Hazardous Air Pollutants (NESHAP) as an *asbestos-containing material (ACM)*.

PERCENTAGES & POINT COUNTING

Reported percentages of asbestos are visual estimates by volume; quantitation is achieved by utilizing a stereobinocular microscope. The Asbestos NESHAP Revision Final Rule states that regulated asbestos-containing materials (as defined in 40 CFR Section 61.141) containing less than 10% asbestos (*including the samples that contain a trace or less than 1% asbestos which are considered by the EPA as asbestos-containing materials if analyzed by Polarized Light Microscopy (PLM)*) may be verified by *point counting*. If the lab detects the asbestos content of a sample to be <10%, the client may: 1) elect to assume the amount to be greater than 1% and treat the material as asbestos containing or 2) require the verification of the amount by point counting. If a result obtained by point counting is different from a result obtained by visual estimation, the point count result will be used. Samples for which no asbestos is detected by the PLM do not need to be point counted.

TYPES OF ASBESTOS:

Asbestos is a general term to one of several naturally occurring fibrous minerals. These are divided into two categories: serpentine and amphiboles. chrysotile, a serpentine, is the most commonly found form of asbestos. The five other types are all amphiboles. These include amosite, (fibrous grunerite), crocidolite (fibrous riebeckite), fibrous anthophyllite, fibrous tremolite and fibrous actinolite.

BACKGROUND MATERIALS:

Materials which do not contain Asbestos are reported for each sample. These background materials are divided into Fibrous and non-fibrous types. Common Fibrous materials include glass, mineral wool, cellulose, paper, and synthetics (nylon, rayon, Dacron). Common non-fibrous materials include binder (glues), mica, quartz, vermiculite, clays, lizardite and talc.

SAMPLE STORAGE:

Bulk samples are double bagged and stored for 90 days unless otherwise arranged with the client. Samples can be returned within 90 day period upon receipt of written authorization and payment of a return fee.

Lab. PR&C No.: % 90989507
 Proj Mngr: Poy Har Kathleen Wu
 Phone No: 817/978-3977 ext1645
 Proj/Instal'n: Fixed Wing Aircraft
 Park, Bldg. 90050
 Electronic Data Format: NO
 FEDEX Acct. No.: 1128-3856-2
 Site/Feature: Ft. Hood

[illegible]

PLM-Point Count EPA 600/R-93/116 3-5

NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable

[illegible]

TEXAS DEPARTMENT OF HEALTH

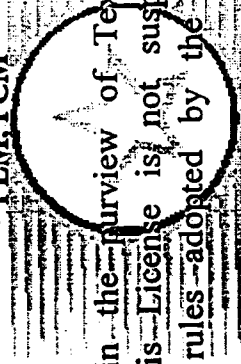
BE IT KNOWN THAT

ECOSYSTEMS ENVIRONMENTAL, INC.

is Licensed and authorized to perform as an

Asbestos Laboratory

PLM, PCM



in the State of Texas within the purview of Texas Civil Statutes, Article 4477-3a, as amended, so long as this License is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

30-0117

License Number

11/02/1998

Issue Date

11/01/1999

Expiration Date

This certificate is void
after expiration date.

Todd F. Wingler

Todd F. Wingler, P.E.
Chief, Asbestos Programs Branch
Occupational Safety and Health Division

William R. Archer III

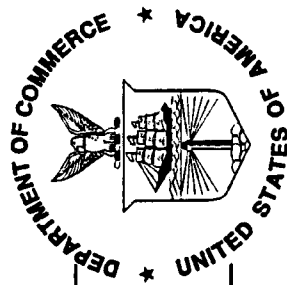
William R. Archer III, M.D.
Commissioner of Health

VOID IF ALTERED NON-TRANSFERABLE

40998

United States Department of Commerce
National Institute of Standards and Technology

NVLAP[®]



ISO/IEC GUIDE 25:1990
ISO 9002:1987

Certificate of Accreditation

ECOSYSTEMS ENVIRONMENTAL, INC.
CARROLLTON, TX

is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation is awarded for specific services, listed on the Scope of Accreditation for:

BULK ASBESTOS FIBER ANALYSIS

March 31, 2000

Effective through

For the National Institute of Standards and Technology

NVLAP Lab Code: 101162-0

BID OPTION NO. 2

QUEST

MicroAnalytics, Inc.

2530 Electronic Lane, Suite 712

Dallas, Texas 75220-1229

Tel 214.351.4441 Fax 214.351.4487

PLM REPORT

NVLAP Lab No. 200249

TDH License No.30-0218

Client: U.S. Army Corps of Engineers
Project: Fort Hood Fixed Wing Aircraft Park
Project No. Building 90049

Request No.: 004062
Report Date: 1/12/00
Sample Date: 1/05/00

Identification: Polarized Light Microscopy/Dispersion Staining (PLM/DS)

Test Method: Method 40 CFR, Ch. 1, Part 763, Subpart F, Appendix A

On 1/07/00, 21 bulk material samples were submitted by Janie Hard of the U.S. Army Corps of Engineers for PLM/DS analysis. The results are outlined below:

Client No.	Lab No.	Sample Description	Fibrous Components	Asbestos Content
A01	0-00200	Gray Window Caulking between Panes	None	None Detected
A02	0-00201	Gray Canvas Flex Connector	30% Cotton 25% Synthetic Fibers	40% Chrysotile
A03	0-00202	Beige Stucco Wall	NA	0.00% Asbestos by Point Count
A04	0-00203	12"x12" Tan Speckled Beige Floor Tile (A) with Black Mastic (B)	None	A) None Detected B) 7% Chrysotile
A05	0-00204	Tape, Sheetrock and Mud	NA	0.00% Asbestos by Point Count
A06	0-00205	12"x12" Tan Floor Tile (A) with Black Mastic (B)	None	A) None Detected B) 5% Chrysotile
A07	0-00206	Beige Flex Connector	45% Synthetic Fibers	50% Chrysotile
A08	0-00207	9"x9" Beige Floor Tile (A) with Black Mastic (B)	None	A) 5% Chrysotile B) 5% Chrysotile
A09	0-00208	Brown Fibrous Sub-Flooring Wood	99% Cellulose	None Detected
A10	0-00209	Sheetrock, Tape and Mud	NA	0.00% Asbestos by Point Count
A11	0-00210	Sheetrock, Tape and Mud	NA	0.00% Asbestos by Point Count
A12	0-00211	Black Flashing around Vent	3% Cellulose	None Detected
A13	0-00212	Roof Tar (A) and Roll Roofing (B)	B) 25% Synthetic	A) None Detected B) None Detected
A14	0-00213	Black Flashing around Vent	3% Cellulose	None Detected
A15	0-00214	White Hard Window Caulking	None	3% Chrysotile
A16	0-00215	White Rubbery Window Caulking	None	None Detected

A17	0-00216	White Rubbery Window Caulking	None	None Detected
A18	0-00217	White Pipe Insulation	None	25% Amosite 15% Chrysotile
A19	0-00218	Flex Connector	45% Synthetic Fibers	50% Chrysotile
A20	0-00219	Flex Connector	45% Synthetic Fibers	50% Chrysotile
A21	0-00220	Beige Plaster Wall	NA	0.00% Asbestos by Point Count

The EPA test method for bulk analysis (EPA/600/R-93/116) states in paragraph 2.2.2. that "the detection limit for visual estimation is a function of the quantity of the sample analyzed, the nature of matrix interference, sample preparation, and fiber size and distribution. Asbestos may be detected in concentrations of less than one percent by area if sufficient material is analyzed. Samples may contain fibers too small to be resolved by PLM (<0.25 micrometers in diameter) so detection of those fibers by this method may not be possible."

Samples are analyzed by layers, and percentages estimated visually during microscopic examination. Individual analysis sheets available upon request. Results may not be reproduced except in full. This test report relates only to the samples tested, and results must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. Samples will be stored for a minimum of 90 days, after which time they will be disposed of unless notified by the client in writing. (Storage fees apply.)

Analyst: Alexis O'Reilly

Lab Director: Jennifer D. Jaber

Approved Signatory



NVLAP

CHAIN OF CUSTODY RECORD

Site/Feature: Ft. Hood

Lab. PR&C No.: % 93190877
 Proj Mgr: Poy Iar Kathleen Wu
 Phone No: 817/978-3977 ext 1645

Electronic Data Format: Use .pdf

Proj/Instal'n: Fixed Wing Aircraft
 Park, Bldg. 90049

Analytes/Test Methods Turn-around Time in Days

PLM EPA 600/R-93/116 3-5

PLM-Point Count EPA 600/R-93/116 3-5

Total Lead (mg/Kg) EPA 6010 6-10

TCLP lead (mg/l) EPA 1311/6010 10

NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable

Date	Field Sample No./Description	Matrix
11/5/2000	90049-A01 Window Caulking Between Panes	Solid
11/5/2000	90049-A02 - Gray Canvas Flex Connector	Solid
11/5/2000	90049-A03 - Stucco Wall	Solid
11/5/2000	90049-A04 - 12" X 12" Floor Tile Beige	Solid
	w/ Tan Specs & black mastic	
11/5/2000	90049-A05 Tape, Sheetrock & mud	Solid
11/5/2000	90049-A06 Tan Floor Tile 12" X 12"	Solid
	w/ black mastic	

Date/Time: 11/7/00 10:40am

Received by:

Date/Time: 11/6/99 1300

Received by:

Date/Time:

Received for lab by:

Date/Time:

Relinquished by:

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Relinquished by:

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

0040002

CHAIN OF CUSTODY RECORD

Site/Feature: Ft. Hood

Proj/Instal'n: Fixed Wing Aircraft

Park, Bldg: 90049

Electronic Data Format: Use .pdf

Lab. PR & C No.: % 93190877

Proj Mgr: Puy Har Kathleen Wu

Phone No: 817/978-3977 ext 1645

FIDEX Accl. No.: 1128-3856-2

Analytes/Test Methods Turn-around Time in Days

PLM EPA 600/R-93/116 3-5

PLM-Point Count EPA 600/R-93/116 3-5

Total Lead (mg/Kg) EPA 6010 6-10

TCLP lead (mg/l) EPA 1311/6010 10

NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable

Date	Field Sample No./Description	Matrix
11/5/2000	90049-A07 Flex Connector (Beige)	Solid
11/5/2000	90049-A08 9"x9" Floor Tile Beige	Solid
	w/ black mastic	
11/5/2000	90049-A09 Brown fibrous sub-flooring wood	Solid
11/5/2000	90049-A10 Sheetrock, tape & mud	Solid
11/5/2000	90049-A11 Sheetrock, tape & mud	Solid
11/5/2000	90049-A12 Flashing around vent	Solid
11/5/2000	90049-A13 Roof Tar & ball roofing	Solid

Received by: J. H. Wu Date/Time: 01-06-2000

Received by: Date/Time:

Received for lab by: Date/Time:

Date/Time: 11/7/00 10:40 AM

Date/Time:

Date/Time:

Relinquished by:

Received by: J. H. Wu

Received for lab by:

PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

CHAIN OF CUSTODY RECORD

Lab. PR&C No.: % 93190877
 Proj Mgr: Roy Har Kathleen Wu
 Phone No: 817/978-3977 ext 1645

Proj/Instal'n: Fixed Wing Aircraft
 Park, Bldg. 90049
 Electronic Data Format: Use .pdf

Site/Feature: Ft. Hood
 FEDEX Acct. No.: 1128-3856-2

Analytics/Test Methods Turn-around Time in Days

PLM	EPA 600/R-93/116	3-5
PLM-Point Count	EPA 600/R-93/116	3-5
Total Lead (mg/kg) EPA 6010		6-10
TCLP Lead (mg/l) EPA 1311/6010		10

NOTE: Report Friability of asbestos in PLM REPORT - on column "Description" By NF = nonfriable and F = friable

Date	Field Sample No./Description	Matrix
11/5/2000	90049-A14 Flashing around vent	Solid
11/5/2000	90049-A15 Window Caulking	Solid
11/5/2000	90049-A16 Window Caulking	Solid
11/5/2000	90049-A17 Window Caulking	Solid
11/5/2000	90049-A18 Pipe Insulation/connector	Solid
11/5/2000	90049-A19 Flex connector	Solid
11/5/2000	90049-A20 Flex connector	Solid
11/5/2000	90049-A21 Plaster wall	Solid

Relinquished by:	Date/Time: 11-16-2000 1300
Relinquished by:	Date/Time:
Relinquished by:	Date/Time:

Received by: [Signature]
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Date/Time: 11/16/2000 10:40am
 Date/Time:
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PROVIDE DATA IN BOTH HARD COPY AND ELECTRONIC FORMAT

SECTION 13920A

FIRE PUMPS

12/01

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2001a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 449	(2000) Quenched and Tempered Steel Bolts and Studs
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 135	(2000) Seamless Brass Tube
ASTM B 42	(1998) Seamless Copper Pipe, Standard Sizes
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1999) Seamless Copper Tube
ASTM B 88	(1999) Seamless Copper Water Tube
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 3308	(1997) PTFE Resin Skived Tape
ASTM F 436	(2000) Hardened Steel Washers

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1992; Addenda B301a - 1999) Liquid Chlorine

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C500	(1993; C500a) Metal-Seated Gate Valves for Water Supply Service
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA EWW	(1999) Standard Methods for the Examination of Water and Wastewater
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

ASME INTERNATIONAL (ASME)

ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection
FM P7825b	(1998) Approval Guide Electrical Equipment

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1998) Motors and Generators
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1963	(1998) Fire Hose Connections
NFPA 20	(1999) Installation of Centrifugal Fire Pumps

NFPA 24 (1995) Installation of Private Fire Service Mains and Their Appurtenances

NFPA 70 (1999) National Electrical Code

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7 (1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 1247 (1995; Rev thru May 1997) Diesel Engines for Driving Centrifugal Fire Pumps

UL 262 (1994; Rev thru Dec 1998) Gate Valves for Fire-Protection Service

UL 448 ((1994; Rev thru May 1999) Pumps for Fire-Protection Service

UL Fire Prot Dir (1999) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Except as modified in this Section or on the drawings, fire pumps shall be installed in conformance with NFPA 20, including all recommendations and advisory portions, which shall be considered mandatory. All reference to the authority having jurisdiction shall be interpreted to mean the Contracting Officer.

1.3 SEQUENCE OF OPERATION

1.3.1 Primary Fire Pump

Primary fire pump shall automatically operate when the pressure drops to 45 psi. The fire pump shall automatically stop operating when the system pressure reaches 135 psi and after the fire pump has operated for the minimum pump run time specified herein.

1.3.1.1 Pressure Maintenance Pump

Pressure maintenance pump shall operate when the system pressure drops to 50 psi. Pump shall automatically stop when the system pressure reaches 100 psi and after the pump has operated for the minimum pump run time specified herein.

1.3.2 Safety Requirements

Coupling, rotating parts, gears, projecting equipment, etc. shall be fully enclosed or properly guarded so as to prevent possible injury to persons that come in close proximity of the equipment. The Contractor shall conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Hoses and nozzles used to conduct flow tests

shall be in excellent condition and shall be safely anchored and secured to prevent any misdirection of the hose streams.

1.4 COORDINATION OF TRADES

Tank supports, piping offsets, fittings, and any other accessories required shall be furnished as specified to provide a complete installation and to eliminate interference with other construction.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed with protection from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall be either capped or plugged until installed.

1.6 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.7 SUBMITTALS

Indicate submittal classification in the blank space following the name of the item requiring the submittal by using "G" when the submittal requires Government approval. Submittals not classified as "G" will show on the submittal register as "Information Only". For submittals requiring Government approval, a code of up to three characters should be used following the "G" designation to indicate the approving authority; codes of "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval are recommended. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Requirements; G

Three copies of the Fire Pump Installation Drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1/2 inch = 1 foot. Drawings shall indicate equipment, piping, and associated pump equipment to scale. All clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment shall be indicated. Drawings shall include a legend identifying all symbols, nomenclatures, and abbreviations. Drawings shall indicate a complete piping and equipment layout including elevations and/or section views of the following:

- a. Fire pumps, controllers, piping, valves, and associated equipment.
- b. Sensing line for each pump including the pressure maintenance pump.
- c. Engine fuel system for diesel driven pumps.

- d. Engine cooling system for diesel driven pumps.
- e. Pipe hangers and sway bracing including support for diesel muffler and exhaust piping.
- f. Restraint of underground water main at entry-point to the building including details of pipe clamps, tie rods, mechanical retainer glands, and thrust blocks.
- g. A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.
- h. A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

As-Built Drawings

As-built drawings, no later than 14 days after completion of the Final Tests. The Fire Pump Installation Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Pump Installation Related Submittals

A list of the Fire Pump Installation Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist and the Manufacturer's Representative.

Installation Requirements; G

Manufacturer's catalog data included with the Fire Pump Installation Drawings for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:

- a. Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but shall be submitted prior to the final tests.
- b. Pressure maintenance pump and controller.
- c. Piping components.
- d. Valves, including gate, check, globe and relief valves.
- e. Gauges.
- f. Hose valve manifold test header and hose valves.
- g. Flow meter.

- h. Restrictive orifice union.
- i. Associated devices and equipment.

Spare Parts

Spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

Preliminary Test

Proposed procedures for Preliminary Tests, at least 14 days prior to the proposed start of the tests.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

System Diagrams; G

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and storage units, and typed condensed sequence of operation, wiring and control diagrams, and operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Fire Protection Specialist; G

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings.

Manufacturer's Representative; G

The name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications.

Field Training; G

Proposed schedule for field training submitted at least 14 days prior to the start of related training.

Final Acceptance Test

Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test.

Notification shall include a copy of the Contractor's Material & Test Certificates.

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

SD-06 Test Reports

Preliminary Test; G

Three copies of the completed Preliminary Tests Reports, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative.

Final Acceptance Test; G

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative. Test reports in booklet form (each copy furnished in a properly labeled three ring binder) showing all field tests and measurements taken during the preliminary and final testing, and documentation that proves compliance with the specified performance criteria, upon completion of the installation and final testing of the installed system. Each test report shall indicate the final position of the controls and pressure switches. The test reports shall include the description of the hydrostatic test conducted on the piping and flushing of the suction and discharge piping. A copy of the manufacturer's certified pump curve for each fire pump shall be included in the report.

SD-07 Certificates

Fire Protection Specialist; G

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the fire pump installation is in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Fire Pumps

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 MANUFACTURER'S REPRESENTATIVE

Work specified in this section shall be performed under the supervision of and certified by a representative of the fire pump manufacturer. The Manufacturer's Representative shall be regularly engaged in the installation of the type and complexity of fire pump(s) specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number. Pumps and motors shall have standard nameplates securely affixed in a conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Diesel driver shall have nameplate and markings in accordance with UL 1247. Electric motor nameplates shall provide the minimum information required by NFPA 70, Section 430-7.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or

"approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe and Fittings

Underground piping and piping under the building slab shall be ductile iron with a rated working pressure of 150 psi conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 5 feet outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.4.3 Valves and Valve Boxes

Valves shall be gate valves conforming to AWWA C500 or UL 262. Valves shall have cast-iron body and bronze trim. Valve shall open by counterclockwise rotation. Except for post indicator valves, all underground valves shall be provided with an adjustable cast-iron or ductile iron valve box of a size suitable for the valve on which the box is to be used, but not less than 5.25 inches in diameter. The box shall be coated with bituminous coating. A cast-iron or ductile-iron cover with the word "WATER" cast on the cover shall be provided for each box.

2.4.4 Buried Utility Warning and Identification Tape

Detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping shall be provided for all buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be color-coded for the utility involved and imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification shall be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Code and lettering shall be permanent and unaffected by moisture and other substances contained in the trench backfill material. Tape shall be buried at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavement.

2.5 ABOVEGROUND PIPING COMPONENTS

2.5.1 Pipe Sizes 2.5 inches and Larger

2.5.1.1 Pipe

Piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 8 inches and greater in diameter), Type E or Type S, Grade A; black steel pipe. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be jointed by welding or weld fittings. Suction piping shall be galvanized on the inside per NFPA 20.

2.5.1.2 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.3 Flanges

Flanges shall be ASME B16.5, Class 150 flanges. Flanges shall be provided at valves, connections to equipment, and where indicated.

2.5.1.4 Gaskets

Gaskets shall be AWWA C111, cloth inserted red rubber gaskets.

2.5.1.5 Bolts

Bolts shall be ASTM A 449, Type 1. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.6 Nuts

Nuts shall be ASTM A 193/A 193M, Grade 5.

2.5.1.7 Washers

Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Piping Sizes 2 inches and Smaller

2.5.2.1 Steel Pipe

Steel piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A, zinc-coated steel pipe with threaded end connections. Fittings shall be ASME B16.39, Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.5.2.2 Copper Tubing

Copper tubing shall be ASTM B 88, Type L, soft annealed. Fittings shall be ASME B16.26, flared joint fittings. Pipe nipples shall be ASTM B 42 copper pipe with threaded end connections.

2.5.3 Pipe Hangers and Supports

Pipe hangers and support shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b and shall be the adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.4 Valves

Valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire protection service. Valves shall have flange or threaded end connections.

2.5.4.1 Gate Valves, Control Valves and Indicator Post

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type which open by counterclockwise rotation. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post. Butterfly-type control valves are not permitted.

2.5.4.2 Tamper Switch

The suction control valves, the discharge control valves, valves to test header and flow meter, and the by-pass control valves shall be equipped with valve tamper switches for monitoring by the fire alarm system.

2.5.4.3 Check Valve

Check valve shall be clear open, swing type check valve with flange or threaded inspection plate.

2.5.4.4 Circulating Relief Valve

An adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

2.6 FIRE PUMP

Fire pump shall be electric motor driven. The pump capacity shall be rated at 1344 gpm with a rated net pressure of 70 psi. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal horizontal split case fire pump. Horizontal pump shall be equipped with automatic air release devices. The maximum rated pump speed shall be 1780 rpm when driving the pump at rated capacity. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type.

2.7 ELECTRIC MOTOR DRIVER

Motor shall conform to NEMA MG 1 and be marked as complying with NEMA Design B standards. Motor horsepower shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

2.8 [AM#2] DELETED

2.9 FIRE PUMP CONTROLLER

Controller shall be the automatic type and UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. Pump shall be arranged for automatic start and stop, and manual push-button stop. Automatic stopping shall be accomplished only after all starting causes have returned to normal and after a minimum pump run time has elapsed. Controllers shall be completely terminally wired, ready for field connections, and mounted in a NEMA Type 4 watertight and dust tight enclosure arranged so that controller current carrying parts will not be less than 12 inches above the floor. Controller shall be provided with voltage surge arresters installed per NFPA 20. Controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory

power light. Controller shall be equipped with a thermostat switch with adjustable setting to monitor the pump room temperature and to provide an alarm when temperatures falls below 40 degrees F. The controller shall be factory-equipped with a heater operated by thermostat to prevent moisture in the cabinet.

2.9.1 Controller for Electric Motor Driven Fire Pump

Controller shall be across the line starting type. Controller shall be designed for 75 HP at 480 volts. Controller shall have a short circuit rating of 100,000 amps r.m.s. symmetrical at 600 volts a.c. Controller shall monitor pump running, loss of a phase or line power, phase reversal, and pump room temperature. Alarms shall be individually displayed in front of panel by lighting of visual lamps. Each lamp shall be labeled with rigid etched plastic labels. Controller shall be equipped with terminals for remote monitoring of pump running, pump power supply trouble (loss of power or phase and phase reversal), and pump room trouble (pump room temperature), and for remote start. Limited service fire pump controllers are not permitted, except for fire pumps driven by electric motors rated less than 15 hp. Controller shall be equipped with a 7-day electric pressure recorder with 24-hour spring wound back-up. The pressure recorder shall provide a readout of the system pressure from 0 to 15 hp, time, and date. Controller shall require the pumps to run for ten minutes for pumps with driver motors under 200 horsepower and for 15 minutes for pumps with motors 200 horsepower and greater, prior to automatic shutdown. The controller shall be equipped with an externally operable isolating switch which manually operates the motor circuit. Means shall be provided in the controller for measuring current for all motor circuit conductors.

2.10 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-7-5.2.1. of NFPA 20. The sensing line shall be 1/2 inch H58 brass tubing complying with ASTM B 135. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a 3/32 inch. Restricted orifice unions shall be mounted in the horizontal position, not less than 5 feet apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 1/2 inch globe valves and 1/4 inch gauge connection tee arranged per NFPA 20. One of the test connections shall be equipped with a 0 to 300 psi water oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.11 PRESSURE MAINTENANCE PUMP

Pressure maintenance pump shall be electric motor driven, in-line vertical shaft, centrifugal type with a rated discharge of 10 gpm at 125 psig. Pump shall draft as indicated and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.11.1 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set for 2 minutes.

2.12 [AM#2] DELETED

2.13 JOINTS AND FITTINGS FOR COPPER TUBE

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Grooved mechanical joints and fittings shall be designed for not less than 125 psig service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 239 degrees F. Grooved joints shall conform to AWWA C606. Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.14 PUMP BASE PLATE AND PAD

A common base plate shall be provided for each horizontal-shaft fire pump for mounting pump and driver unit. The base plate shall be constructed of cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Each base plate for the horizontal fire pumps shall be provided with a 1 inchgalvanized steel drain line piped to the nearest floor drain. For vertical shaft pumps, pump head shall be provided with a cast-iron base plate and shall serve as the sole plate for mounting the discharge head assembly. Pump units and bases shall be mounted on a raised 6 inches reinforced concrete pad that is an integral part of the reinforced concrete floor.

2.15 HOSE VALVE MANIFOLD TEST HEADER

Hose valve test header shall be connected by ASME B16.5, Class 150 flange inlet connection. Hose valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b bronze hose gate valves with 2.5 inches American National Fire Hose Connection Screw Standard Threads (NH) per NFPA 1963. The number of valves shall be per NFPA 20. Each hose valve shall be equipped with a cap and chain, and located no more than 3 feet and no less than 2 feet above grade.

2.16 FLOW METER

Meter shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825bas flow meters for fire pump installation with direct flow readout device. Flow meter shall be capable of metering any waterflow quantities between 50 percent and 150 percent of the rated flow of the pumps. The flow meter shall be arranged in accordance with Figure A-2-14.2.1 of NFPA 20.

The meter throttle valve and the meter control valves shall be O.S.&Y. valves. Automatic air release shall be provided if flow meter test discharge is piped to the pump suction and forms a closed-loop meter arrangement as defined in Figure A-2-14.2.1 of NFPA 20.

2.17 PIPE SLEEVE

A pipe sleeve shall be provided at each location where piping passes through walls, ceilings, roofs, and floors, including pipe entering buildings from the exterior. Sleeves shall be grouted in position during construction. Sleeve shall be of sufficient length to pass through the entire thickness of the wall, ceilings, roofs and floors. The space between the exterior surface of the pipe and the interior surface of the sleeve shall be firmly packed with mineral wool insulation and caulk at both ends with plastic waterproof cement which will dry to a firm but pliable mass, or with a segmented elastomeric seal. Where pipes pass through fire walls or fire floors, a fire seal shall be provided between the pipe and the sleeve in accordance with Section 07840A FIRESTOPPING. Sleeves in masonry and concrete walls, ceiling, roofs and floors shall be hot-dip galvanized steel. Other sleeves shall be galvanized steel sheet pipe not less than 0.90 psf.

2.18 ESCUTCHEON (WALL) PLATES

Escutcheon plates shall be one-piece or split-hinge type metal plates and shall be provided for piping passing through floors, walls, and ceiling in exposed areas. In finished areas, plates shall be chromium-plated finish on copper alloy. In unfinished areas, plates shall have painted finish. Plates shall be secured in position.

2.19 DISINFECTING MATERIALS

2.19.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.19.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

PART 3 EXECUTION

3.1 FIRE PUMP INSTALLATION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation the fire pump(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the fire pump installation

periodically assure that the installation conforms to the contract requirements. The Fire Protection Specialist shall perform a thorough inspection of the fire pump installation, including visual observation of the pump while running shall be conducted. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Specialist shall witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, shall sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.3 INSTALLATION REQUIREMENTS

Installation, workmanship, fabrication, assembly, erection, examination, inspection and testing shall be in accordance NFPA 20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.4 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used.

3.4.1 Cleaning of Piping

Interior and ends of piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.4.2 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308 and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 1 mil.

3.4.3 Pipe Hangers and Supports

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.4.3.1 Vertical Piping

Piping shall be supported at each floor, at not more than 10 foot intervals.

3.4.3.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	1 and Under	1.25	1.5	2	2.5	3	3.5	4	5	6+
Copper Tube	6	7	8							
Steel Pipe	7	8	9	10	11	12	13	14	16	17

3.4.4 Underground Piping

Installation of underground piping and fittings shall conform to NFPA 24. Joints shall be anchored in accordance with NFPA 24. Concrete thrust block shall be provided at elbow where pipe turns up towards floor, and the pipe riser shall be restrained with steel rods from the elbow to the flange above the floor. After installation per NFPA 24, rods and nuts shall be thoroughly cleaned and coated with asphalt or other corrosion-retard material approved by the Contracting Officer. Minimum depth of cover shall be 3 feet.

3.4.5 Grooved Mechanical Joint

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.5 ELECTRICAL WORK

Electric motor and controls shall be in accordance with NFPA 20 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided in accordance with NFPA 20 and Section 16415A ELECTRICAL WORK, INTERIOR.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 [AM#2]
 Paints and Coatings.

3.7 FLUSHING

The fire pump suction and discharge piping shall be flushed at 120 percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing shall be the total quantity of water flowing when all pumps are discharging at 120 percent of their rated

capacities. The new pumps may be used to attain the required flushing volume. Flushing operations shall continue until water is clear, but not less than 10 minutes. The Contractor shall submit a signed and dated flushing certificate before requesting field testing.

3.8 FIELD TESTS

3.8.1 Hydrostatic Test

Piping shall be hydrostatically tested at 225 psig for a period of 2 hours, or at least 50 psi in excess of the maximum pressure, when the maximum pressure in the system is in excess of 175 psi.

3.8.2 Preliminary Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, a representative of the fire pump controller manufacturer, and a representative of the fire pump manufacturer shall witness the complete operational testing of the fire pump and drivers. The fire pump controller manufacturer's representative and the fire pump manufacturer's representative shall each be an experienced technician employed by the respective manufacturers and capable of demonstrating operation of all features of respective components including trouble alarms and operating features. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps shall run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, the corrections shall be made and the entire preliminary test shall be repeated.

3.8.3 Final Acceptance Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, the fire pump controller manufacturer's representative, and the fire pump manufacturer's representative shall also witness for the final tests. The Contractor shall be responsible for repairing any damage caused by hose streams or other aspects of the test. The final acceptance test shall include the following:

3.8.3.1 Flow Tests

Flow tests using the test header, hoses and playpipe nozzles shall be conducted. Flow tests shall be performed at churn (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Flow readings shall be taken from each nozzle by means of a calibrated pitot tube with gauge or other approved measuring equipment. Rpm, suction pressure and discharge pressure reading shall be taken as part of each flow test. Voltage and ampere readings shall taken on each phase as part of each flow test for electric-motor driven pumps.

3.8.3.2 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. The fire pumps shall be operated for a period of a least 10 minutes for each of the starts; except that electric motors over 200 horsepower shall be operated for at least 15 minutes and shall not be started more than 2 times in 10 hours. Pressure settings that include automatic starting and stopping of the fire pump(s) shall be indicated on an etched plastic placard, attached to the corresponding pump controller.

3.8.3.3 Alarms

All pump alarms, both local and remote, shall be tested.

3.8.3.4 Miscellaneous

Valve tamper switches shall be tested. Pressure recorder operation relief valve settings, valve operations, operation and accuracy of meters and gauges, and other accessory devices shall be verified.

3.8.4 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, the Contractor shall performed corrective actions and repeat the tests. Tests shall be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.8.5 Test Equipment

The Contractor shall provide all equipment and instruments necessary to conduct a complete final test, including 2.5 inch diameter hoses, playpipe nozzles, pitot tube gauges, portable digital tachometer, voltage and ampere meters, and calibrated oil-filled water pressure gauges. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. The Government will furnish water for the tests.

3.8.6 Test Documentation

The Manufacturer's Representative shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Specialist shall record all test results and plot curve of each pump performance during the test. Complete pump acceptance test data of each fire pump shall be recorded. The pump acceptance test data shall be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. All test data records shall be submitted in a three ring binder.

3.9 DISINFECTION

After all system components are installed including pumps, piping, and other associated work, and all hydrostatic test(s) are successfully completed, thoroughly flush the pumps and all piping to be disinfected with potable water until there is no visible sign of dirt or other residue. and hydrostatic test are successfully completed, each portion of the piping specified in this Section system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign

materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 FIELD TRAINING

The Fire Protection Specialist and the Manufacturer's Representative shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the fire pump installation is functionally complete but prior to the start tests specified herein. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 13930A

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

04/02

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 135	(2001) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM F 436	(2000) Hardened Steel Washers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	(1999) Double Check Backflow Prevention Assembly
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AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1992; Addenda B301a - 1999) Liquid Chlorine
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

AWWA C203 (1997; Addenda C203a - 1999) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA EWW (1999) Standard Methods for the Examination of Water and Wastewater

AWWA M20 (1973) Manual: Water Chlorination Principles and Practices

ASME INTERNATIONAL (ASME)

ASME B16.1 (1998) Cast Iron Pipe Flanges and Flanged Fittings

ASME B16.11 (1996) Forged Fittings, Socket-Welding and Threaded

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.3 (1998) Malleable Iron Threaded Fittings

ASME B16.4 (1998) Gray Iron Threaded Fittings

ASME B16.9 (1993) Factory-Made Wrought Steel Buttwelding Fittings

ASME B18.2.1 (1996) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (1987; R 1993) Square and Hex Nuts (Inch Series)

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (1998) Approval Guide Fire Protection

FM P7825b (1998) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71 (1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2000) Life Safety Code

NFPA 13 (1999) Installation of Sprinkler Systems

NFPA 13D (1996) One- and Two-Family Dwellings and Manufactured Homes Sprinkler Systems

NFPA 13R (1999) Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height

NFPA 1963	(1998) Fire Hose Connections
NFPA 230	(1999) Fire Protection of Storage
NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)

NICET 1014-7	(1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout
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UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(1999) Building Materials Directory
UL Fire Prot Dir	(1999) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in areas indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density according to the hazard indicated. The minimum pipe size for branch lines in gridded systems shall be 1-1/4 inch. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 20 ft/s.

1.2.1.1 Hose Demand

An allowance for exterior hose streams of 500 gpm shall be added to the sprinkler system demand at the point of connection to the existing system.

1.2.1.2 Basis for Calculations

Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping. Hydraulic calculations shall be based on operation of the fire pump(s) provided in Section 13920A FIRE PUMPS for Building B (Pallet Warehouse).

1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces.

Coverage per sprinkler shall be in accordance with NFPA 13; as specified in NFPA 13 for extra hazard occupancy but not to exceed 225 square feet for light hazard or 130 square feet for ordinary hazard occupancies. Exceptions are as follows:

1) Facilities that are designed in accordance with NFPA 13R and NFPA 13D.

2) Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Sprinkler System Shop Drawings; G.

Three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation. The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13.

Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test

connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

As-Built Shop Drawings.

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Protection Related Submittals.

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Components and Equipment Data; G.

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

Preliminary Tests Procedures; G.

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests.

Final Acceptance Test Procedures; G.

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

On-site Training Schedule; G.

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Preliminary Tests; G.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

Final Acceptance Test; G.

Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

Fire Protection Specialist Qualifications; G.

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer Qualifications; G.

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

SD-06 Test Reports

Preliminary Tests Report; G.

Three copies of the completed Preliminary Tests Reports, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test Report; G.

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed

by the Fire Protection Specialist.

SD-07 Certificates

Fire Protection Specialist Inspection; G.

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Wet Pipe Sprinkler System.

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer

and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 SPRINKLER SYSTEM INSTALLER QUALIFICATIONS

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe

Piping from a point 6 inches above the floor to a point 5 feet outside the building wall shall be ductile iron with a rated working pressure of 150 psi conforming to AWWA C151. Piping more than 5 feet outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.5 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel.

2.5.1 Steel Piping Components

2.5.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53/A 53M, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.5.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall be approved for fire protection systems. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.5.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer; segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type.

2.5.1.5 Bolts, Nut, and Washers

Bolts shall be squarehead conforming to ASME B18.2.1 and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be hexagon type conforming to ASME B18.2.2. Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.5.3 Valves

2.5.3.1 Control Valve, Gate Valve and Indicator Post

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post.

2.5.3.2 Check Valve

Check valve 2 inches and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.6 ALARM CHECK VALVE ASSEMBLY

Assembly shall include an alarm check valve, standard trim piping, pressure gauges, bypass, retarding chamber, testing valves, main drain, and other components as required for a fully operational system.

2.7 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Mechanically operated, exterior-mounted, water motor alarm assembly shall be provided and installed in accordance with NFPA 13. Water motor alarm assembly shall include a body housing, impeller or pelton wheel, drive shaft, striker assembly, gong, wall plate and related components necessary for complete operation. Minimum 3/4 inch galvanized piping shall be provided between the housing and the alarm check valve. Drain piping from the body housing shall be minimum 1 inch galvanized and shall be arranged to drain to the outside of the building. Piping shall be galvanized both on the inside and outside surfaces.

2.8 ALARM INITIATING AND SUPERVISORY DEVICES

2.8.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 10 gpm or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.8.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.9 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium plated finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.10 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be as indicated. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used. Sprinklers for the Base Operations and Deployment Buildings shall be the quick response type for areas classified as light hazard or ordinary hazard in accordance with NFPA 13. Sprinklers for the Pallet Warehouse shall be ESFR heads for high rack storage to 20 feet, extra hazard, Class IV commodities. Coverage shall be ESFR sprinklers below roof structure with no in-rack sprinkler system.

2.10.1 Concealed Sprinkler

Concealed sprinkler shall be quick-response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.10.2 Recessed Sprinkler

Upright sprinkler shall be quick-response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.10.3 Flush Sprinkler

Flush sprinkler shall be quick-response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.10.4 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, quick-response type with nominal 1/2 inch orifice. Pendent sprinklers shall have a polished chrome finish.

2.10.5 Upright Sprinkler

Upright sprinkler shall be quick-response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.10.6 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 1/2 inch orifice. Sidewall sprinkler shall have a polished chrome finish. Sidewall sprinkler shall be the quick-response type.

2.10.7 Early Suppression Fast Response (ESFR) Sprinklers

Pendant type ESFR sprinklers shall be of the fusible strut or glass bulb type with nominal 0.87-inch (22 mm) orifice. Body shall be rough brass.

2.11 DISINFECTING MATERIALS

2.11.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.11.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.12 ACCESSORIES

2.12.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.12.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.12.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

[AM#2]2.12.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in Mechanical Rooms and storage rooms.

2.12.5 Identification Sign

Valve identification sign shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.13 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

Double-check backflow prevention assembly shall comply with ASSE 1015. The

assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include pressure gauge test ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 150 psi. The maximum pressure loss shall be 6 psi at a flow rate equal to the sprinkler water demand, at the location of the assembly. A test port for a pressure gauge shall be provided both upstream and downstream of the double check backflow prevention assembly valves.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 230.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.4.2 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.3 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent

sprinklers when the arm-over exceeds 12 inches. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.4.3.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be located in center of ceiling tile.

3.4.4 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

3.4.5 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site.

Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.4.6 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.4.7 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled or sleeved and

provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840A FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.8 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.9 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected to the remote branch line; a test valve located approximately 7 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.4.10 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as indicated and as required by NFPA 13. When the capacity of trapped sections of pipe is less than 3 gallons, the auxiliary drain shall consist of a valve not smaller than 1/2 inch and a plug or nipple and cap. When the capacity of trapped sections of piping is more than 3 gallons, the auxiliary drain shall consist of two 1 inch valves and one 2 x 12 inch condensate nipple or equivalent, located in an accessible location. Tie-in drains shall be provided for multiple adjacent trapped branch pipes and shall be a minimum of 1 inch in diameter. Tie-in drain lines shall be pitched a minimum of 1/2 inch per 10 feet.

3.4.11 Installation of Fire Department Connection

Connection shall be mounted as shown. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.4.12 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in

accordance with NFPA 24. Minimum depth of cover shall be 3 feet. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 5 feet outside the building walls shall meet the requirements of Section 02510A WATER DISTRIBUTION SYSTEM.

3.6 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02315A EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.7 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE.

All wiring for supervisory and alarm circuits shall be #14 AWG solid copper installed in metallic tubing or conduit. Wiring color code shall remain uniform throughout the system.

3.8 DISINFECTION

After all system components are installed and hydrostatic test(s) are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until

satisfactory bacteriological results have been obtained. After successful completion, verify installation of all sprinklers and plugs and pressure test the system.

3.9 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.10 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.10.1 Underground Piping

3.10.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

3.10.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

3.10.2 Aboveground Piping

3.10.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.10.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. A metal placard shall be provided on the backflow prevention assembly that lists

the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.10.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.10.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.11 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

3.12 ON-SITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 4 hours of normal working time and shall start after the system is functionally complete but prior to the Preliminary Tests and Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 15055

MECHANICAL EQUIPMENT, FUELING
AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM C 827	(1987) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
ASTM D 4355	(1984) Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1989) Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1985; R 1990) Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1986) Breaking Load and Elongation of Geotextiles (Grab Method)
ASTM D 4751	(1987) Test Method for Determining the Apparent Opening Size of a Geotextile
ASTM D 4833	(1988; R1996) Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

MILITARY SPECIFICATIONS (MS)

MS MIL-T-83133	(Rev. C, 1990; Amend. 1) Turbine Fuels, Aviation, Kerosene Types, NATO F-34(JP-8) and NATO F-35
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MILITARY STANDARDS (MIL-STD)

MIL-STD-130 (Rev. G, 1988) Identification Marking of
U.S. Military Property

MIL-STD-161 (Rev. F, 1985; Notice 2) Identification
Methods for Bulk Petroleum Products
Systems Including Hydrocarbon Missile Fuels

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3275A (1994) Acrylonitrile Butadiene (NRB)
Rubber Sheet, Non-Asbestos Fiber Fuel and
Oil Resistant

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Catalog Data

Pump Controls; GA.

Hydrant Outlet Pits; GA.

Hydrant Outlet Pits; GA.

SD-04 Drawings

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the equipment and systems.

Hydrant Outlet Pits; GA.

Provide the drawings as one package with the design analysis. Shop fabrication drawings shall include type of material, configuration, thickness, and necessary details of construction of the vault. Shop drawings shall also show the steel grating and supports.

SD-09 Reports

Test Reports

Leak Detection System; GA.

SD-13 Certificates

Certificates of Compliance

Coating Products; GA.

UL Labeled products; GA.

Pits; GA.

Geotextile; FIO.

SD-19 Operation and Maintenance Manuals

Operation and maintenance information shall be submitted for the equipment items or systems listed below.

Pump Controls; GA.

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Components shall be suitable for use with JP-8 turbine fuel; specific gravity 0.81 at 60 degrees F. (15 degrees C), viscosity 1.62 CS at 60 degrees F. (15 degrees C), Reid vapor pressure less than 0.05 psi (0.34 kPa), MS MIL-T-83133. Components to be ANSI Class 150 (275 PSIG at 100 degrees F.) (654 kPag at 38 degrees C) unless noted otherwise. Components to be suitable for outside, unsheltered location, and to function normally in ambient temperatures between 31 degrees F. (-1 degrees C) and 99 degrees F (37 degrees C).

2.2 COMPOSITION OF MATERIALS

Materials in contact with the fuel shall be noncorrosive. No zinc-coated metals, stainless steel, brass, bronze, iron, lead or lead alloys, copper or copper alloys, or other light metal alloys containing more than 4% copper shall be used in contact with the fuel.

2.3 ELECTRICAL WORK

Protective or signal devices required for the operation specified herein shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

2.4 MATERIALS AND EQUIPMENT

All items of material and equipment shall be new and of the best quality used for the purpose in commercial practice and shall be products of reputable manufacturers. Each major component of equipment shall have the manufacturer's name, address and catalog number on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent only will not be acceptable. Equipment, assemblies and parts shall be marked for identification in accordance with MIL-STD-130 and MIL-STD-161.

2.4.1 Supplier

The Contractor's attention is directed to the fact that the pump control system, including but not limited to pump control panel, transmitters and control valves with all hardware and software is an integrated system, shall be furnished by a single systems supplier regularly engaged in the

supplying of this equipment. Supplier shall provide all equipment and appurtenances regardless of manufacture, and be responsible to the Contractor for satisfactory integration of new piping and controls with the existing system. Substitutions of functions specified will not be acceptable. The Contractor shall coordinate the work of the system manufacturer's service personnel during construction, testing, calibration, and acceptance of the system.

2.5 GASKETS

Gaskets shall be in accordance with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.6 BOLTS AND NUTS

Bolts and nuts shall be in accordance with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.7 PUMP CONTROLS

The supplier shall be responsible for furnishing components that are compatible and that operate as a system to perform the required pump control functions. Each item of equipment specified hereafter shall have manufacturer's authorized service personnel present to assist in PERFORMANCE TESTING as specified in Section 15899 SYSTEM START-UP, FUELING SYSTEM. Items specified under this paragraph shall be submitted for approval.

2.8 FUEL SYSTEM HYDRANT PITS WITH LOAD RATED LIDS

Hydrant pits (H-6 and H-7) shall be prefabricated units that are the standard products of a firm regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 3 years prior to bid opening. The pits shown on the drawings are clear opening 41" x 75" pits produced by Dabico, Inc., of Costa Mesa, CA. The Dabico pits (Model DAB-741/65-FHES-4-GL-DC4-XHL-72D) shall be as provided in the existing Phase I pits, including compact counterweights with associated grate modifications, and shall be included as a part of the contractor's cost and responsibility. The basic pit shall consist of a structurally reinforced 0.5-inch (13 mm) thick fiberglass wall and floor with a moment of inertia of 3.5 in^4 or a 0.5" thick fiberglass wall and floor. The fiberglass walls and floor with main body dimensions as shown on the drawings. The integral fiberglass top flange shall require no exposed corrosive material, weldments, or strongbacks within the pit to support the aluminum cover assembly. The manufacturer shall have had a minimum of three years successful experience in the production and usage of their fiberglass service pits and shall supply proof of experience at time of submittals. Pits shall be provided with removable aluminum grating platform suitable for loading of minimum 400 pounds per square foot (1952 Kg/square meter). The grating shall cover the entire opening when the lid is in the open position. Each pit shall be furnished with a 100mm drain line sleeve, and sleeves to accommodate fuel lines entering and leaving the pits the as shown on the contract drawings. The electrical conduit wall penetrations are to be drilled in the field and sleeved prior to placing the reinforced concrete around the fiberglass pits or core drilled after concrete placement. Piping sleeves shall be either stainless steel or FRP pipe sized to accommodate the fuel piping. These premanufactured fiberglass pits become the inner form for the concrete and shall be of sufficient rigidity

and temporarily supported to prevent deformation when the exterior reinforced concrete is placed. The concrete shall also be placed with care to fill under the pit cover bearing edges as the wheel load is transferred from the pit cover to the concrete around the pit.

2.8.1 Pit Cover

The lid shall be attached to the frame with hinges which do not carry wheel loads applied to the top surface of the lid in its closed position. The lid shall be equipped with a device to hold the lid in its fully-opened position. This lid-staying device shall automatically engage when the lid is opened to its fully-opened position. The device shall also be provided with a quick-release mechanism designed to be operated with one hand. The lid shall be considered fully-open when it is rotated approximately 90 degrees from its closed position. Each cover lid shall move smoothly through its entire range of motion and shall be counterbalanced sufficiently to require an externally-applied opening force of 35 pounds (16 Kg) (maximum) to be applied to the center of the long side of the cover (opposite the hinge side). Similarly, the maximum closing force required to be applied at the same point shall be approximately 50 pounds (23 Kg). In addition, the cover shall be counterbalanced in such a fashion that the cover will not close under its own weight if released when open to any angle greater than 70 degrees (from its closed position). Operation of the lid will not have spring assist. Lifting handles (two minimum) shall be provided for each lid. Each handle shall provide comfortable, secure grip for and average adult male's full (gloved) hand. All covers shall be provided with a latch, operable from the exterior of the vault, to securely hold the lid to the frame in the closed position. The latch will be capable of being released from either lifting handle. Tools shall not be required to engage (or disengage) the latch or the lid lifting handles. Latch and handle designs shall be weather-resistant with features to preclude freeze-up and the collection of dirt and precipitation. The pit and cover assemblies shall present a surface which is 3-inch (75 mm) above the concrete pavement upon completing their installation. Projections of the lid's hinges, lifting handles, or latches above the plane of the lid, whether temporary or permanent, shall not be allowed. The weight bearing flange surfaces of both the fiberglass pit liner and the aluminum cover lid shall be machined flat to assure uniform weight distribution. The word FUEL shall be integrally cast in raised letters on the top surface of each lid. The lettering shall be a minimum of 1-inch (25 mm) high and raised to 0.0625-inch (1.5 mm).

2.8.2 Pit Cover Materials, Design, and Testing

All cover lids and frames shall be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 200,000-pound (90720 Kg) test-load applied perpendicular to a 200-square-inch (129,000-square-mm) contact area (10 inches by 20 inches)(254 mm by 508 mm) of the cover's top surface. The aluminum alloy material selected for design shall be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers shall be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects shall not be allowed. Minor cosmetic welding is acceptable. The cover shall be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized yielding or cracking or excessive deformations shall be considered as failure. Actual load-tests shall be performed on a minimum of 50 percent of all the covers supplied. Load-tested units shall be randomly selected. Load-test conditions shall

model field-installed conditions as nearly as practicable. The 200 Kip (90720 Kg) test-load shall be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load shall not exceed 1/180th of the minimum interior opening dimension of the fiberglass pit body. Maximum deflection of the cover remaining after removal of the test load shall be + 0.010-inches (.254 mm) to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame shall be carefully examined for cracks or localized areas of permanent deformation. All results shall be submitted for review and approval. A single failure to meet any of the stated criteria shall be considered sufficient grounds for the testing of the other unit.

2.8.3 Pipe Seal

The pipe penetrations through the pit floor or wall shall be sealed as shown in the drawings by means of a Buna-N boot or Link Belt seal or both. If no seal is shown, then a Link Belt seal shall be used. The Buna-N boot shall be secured to a metal collar welded to the pipe riser and to a flange at the pit penetration by stainless steel clamps. Buna-N boot collar shall be fabricated from the same material as the pipe. Link belt seals will be designed for use with JP-8. Buna-N (nitrile butadiene) material shall be in accordance with SAE AMS 3275A.

2.9 LEAK DETECTION SYSTEM

The new additions to the existing leak detection system (LDS) shall be provided and constructed as shown on the contract drawings using leak detection line/cable (LDL) that will detect only hydrocarbon liquid (JP-8) without detecting water. The new additions shall be of the same manufacturer (Trace Tek by Tyco Thermal Controls, [AM#2]_____ Redwood City, CA) and shall integrate with and perform as the existing system. The LDS system shall have replaceable LDL's. LDS must be capable of detecting multiple leaks at the same time. LDS must be capable of reporting the location of the leak within [AM#2]___5' of the leak. The existing leak detection system consists of a control panel with three leak detection circuit channels for monitoring the layout. This existing system of control panel leak detection cable, connectors and splices, sensor connections and terminations has been tested, validated and is operating per manufacturer's claims regarding sensitivity, range and performance. The [AM#2]_____ leak detection system, during a leak event, shall be capable of monitoring the entire sensing string of all channels[AM#2]_____. The system shall locate the point of the origin of the leak detection of the first leak or fault within 1% of the distance from the last calibration point along the string or 5 feet, whichever is greater.

Leak Detection Control Panel:

The leak detection control panel is existing.

The new leak detection [AM#2]cable shall be integrated into the existing system and the system remapped [AM#2]_____ so that the distance and position of all [AM#2]_____ cable to aboveground features is established +/- [AM#2]_____5 feet. A white map with black lines and plastic laminate 24" x 36" map showing the leak detection circuits and their mapped length indicate all stations measurements on the drawing[AM#2]_____, the fuel pit locations, and the mapped locations of the hand pull boxes of the leak detection conduit system so that when a leak event indicated its

circuit # and distance this can be quickly and reliably visually identified on the drawing. The mapped system drawing shall be hung above or nearby the leak detection control panel.

Leak Detection Sensor Cable(LDL):

The sensor cable shall be designed to detect [AM#2]_____ the presence of Hydrocarbons while ignoring water and water based fluids [AM#2]_____. Manufacturer shall provide Third Party Certification to the appropriate EPA approved test protocol. The cable shall be Trace Tek No. TT5000 to match existing.

Perforated Piping for protecting and pulling in the leak detection cable:

100mm perforated PVC ASTM F758 TYPE PS 46 pipe shall be installed under all fuel pits and piping as shown on the contract drawings. The perforations shall be between 3/16 (5 mm) inch and 1/8 inch (3 mm) with a minimum open area of 0.5 square inch per linear foot (1058 square mm per linear meter). The perforated piping shall have no more than the 270 degrees of fittings from hand-pull box to pull box. there are 2- 90 elbows and 2-45 elbows on the system runs out to the hand pull box past each hydrant pit. After final grade is set on pull box, provide solvent fuse cut rings from couplings to secure the PVC pipe to the pull box. Pipe elbows will have a three foot radius. The pipe will be wrapped in a geotextile material.

2.9.1 Geotextiles

Geotextiles shall be a nonwoven pervious sheet of polymeric material. Fibers used in the manufacture of the geotextile shall consist of long-chain synthetic polymers composed of at least 85% by weight polyolefins, polyesters, or polyamides. Stabilizers and/or inhibitors shall be added to the base polymer if necessary to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the selvages. The geotextile physical properties shall equal or exceed the minimum average roll values listed in Table 1. Strength values shown are for the weaker principal direction.

TABLE 1. GEOTEXTILE PHYSICAL PROPERTIES

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>TEST VALUE</u>
Apparent Opening Size (U.S. Sieve)	ASTM D 4751	70
Permittivity, sec1	ASTM D 4491	0.5
Puncture, lbs	ASTM D 4833	40
Grab Tensile, lbs	ASTM D 4632	115
Trapezoidal Tear, lbs	ASTM D 4533	40
Ultraviolet Degradation (percent strength retained at 500 hours)	ASTM D 4355	70

2.10 HYPALON TRENCH BOTTOM LINER

Industrial Grade 36 mil reinforced with one ply of 10 x 10 x 1000 scrim. Meeting 300% elongation and 1500 psi tensile strength as minimums in accordance with ASTM D-412 test methods for Oil and Gas resistant product.

Installation:

A factory authorized field representative of the leak detection system manufacturer's firm shall train all personnel involved in the installation of the cable. This training shall occur in the presence of a US Army Corps of Engineers Construction Representative. The names of the individuals trained shall be recorded and only those individuals shall participate in the installation of the leak detection system. The manufacturer's representative shall remain on site while all cable is pulled and terminated. When the system installation is completed, the manufacturer's representative shall commission the system and demonstrate its functionality. The manufacturer's representative shall return at the completion of the entire construction project to recommission, correct any and all defects and train the using personnel, 5 maximum, on the operation, maintenance and care of the system.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

Install equipment and components in position, true to line, level and plumb, and measured from established benchmarks or reference points. Follow manufacturer's recommended practices for equipment installation. Provide required clearances between equipment components. Equipment, apparatus, and accessories requiring normal servicing or maintenance to be accessible.

3.1.2 Anchoring

Anchor equipment in place as necessary. Check alignment of anchor bolts before installing equipment and clean-out associated sleeves. Do not cut bolts because of misalignment. Notify Contracting Officer of errors and obtain the Contracting Officer's acceptance before proceeding with corrections. Cut anchor bolts of excess length to the appropriate length without damage to threads. Where anchor bolts or like devices have not been installed, provide appropriate self-drilling type anchors for construction condition.

3.1.3 Grouting

Equipment which is anchored to a pad to be grouted in place. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing water, debris, oil, rust, and coatings which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and rust by hand or power tool methods. Provide necessary formwork for placing and retaining grout. Grout to be non-metallic, non-shrink, fluid precision grout of a hydraulic cementitious system with graded and processed silica aggregate, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum powder agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, pre-mixed and packaged at factory with only the addition of water required at the project

site. Grouting shall be in accordance with ASTM C 827. Perform all grouting in accordance with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.1.4 Leveling and Aligning

Level and align equipment in accordance with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or wedges to support, level or align equipment. Install only flat shims for leveling equipment. Place shims to fully support equipment. Wedging is not permitted. Shims to be fabricated flat carbon steel units of surface configuration and area not less than equipment bearing surface. Shims to provide for full equipment support. Shim to have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges not acceptable.

3.2 INSTALLATION OF FIBERGLASS PITS

The Contractor shall submit recommended installation procedures and setting tolerances from the pit manufacturer/supplier for the fiberglass pit and the aluminum cover. These procedures shall indicate recommended methods of supporting the pit in its proper position in the open excavation prior to and during concrete placement operations. Also, required installation tolerances, especially for flatness/levelness of the fiberglass pit lip, shall be provided. The Contractor shall follow these recommendations and shall apply other procedures as required to ensure the integrity of the pit liner and cover assemblies in their installed positions. All penetrations through the fiberglass pit liner shall be tightly sealed by suitable means to preclude water infiltration, with consideration for potential relative movements between the penetrating objects and the pit liner. Structural Design drawings are to be referenced for the design of the reinforced concrete that surrounds the fiberglass pit on all four walls, under and protects the beveled area over the counterweights.

3.3 POSTED OPERATING INSTRUCTIONS

For each designated system or equipment item, provide instructions for guidance of operating and maintenance personnel. Following approval of content, prepare these instructions in a form and scale that will be readily legible when displayed in appropriate locations, to be designated by the Contracting Officer and meet the following requirements:

3.3.1 Each System

For each system, include diagrams of equipment, piping, wiring and control. Define control sequences.

3.3.2 Each Item

For each equipment item, include starting, adjustment, operation, lubrication, safety precautions and shut-down procedures. Identify procedures to be performed in event of equipment failure. Provide other instructions recommended by the manufacturer.

3.3.3 Diagrams

The Contractor shall provide a professionally prepared piping diagram of the additional fueling system apparatus and the leak detection system map so that, given the readout on the leak detection panel by circuit and

linear feet, the operator can easily identify the location of the reported leak. Diagram shall be color coded to match PCP color diagrams. Diagram shall show the integration of the new fuel system and leak detection system into the existing system. The diagram shall include all associated control valves and equipment with their operational sequences and equipment numbers displayed. The diagram shall be wall mounted under glass.

3.3.4 Volume of Fuel

The Contractor shall provide a certified system inventory of fuel in the pipe. Verify during initial fill.

-- End of Section --

SECTION 15190A

GAS PIPING SYSTEMS

12/01

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN GAS ASSOCIATION (AGA)

AGA Manual (1994; Addenda/Correction Jan 1996) A.G.A.
Plastic Pipe Manual for Gas Service

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (1994; Supple 1 Jun 1996; Supple 2 Dec
1997) Pipeline Valves (Gate, Plug, Ball,
and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2513 (2000) Thermoplastic Gas Pressure Pipe,
Tubing, and Fittings

ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General
Purpose (Inch)

ASME B16.11 (1996) Forged Fittings, Socket-Welding and
Threaded

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe
Flanges

ASME B16.3 (1998) Malleable Iron Threaded Fittings

ASME B16.33 (1990) Manually Operated Metallic Gas
Valves for Use in Gas Piping Systems Up to
125 psig (Sizes 1/2 through 2

ASME B16.5 (1996; B16.5a) Pipe Flanges and Flanged
Fittings NPS 1/2 thru NPS 24

ASME B16.9 (1993) Factory-Made Wrought Steel
Buttwelding Fittings

ASME B31.1 (1998) Power Piping

ASME B31.2 (1968) Fuel Gas Piping

ASME B36.10M (1996) Welded and Seamless Wrought Steel Pipe

ASME BPVC SEC IX (1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25 (1998) Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-58 (1993) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports - Selection and Application

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (1999) National Fuel Gas Code

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL Gas&Oil Dir (1999) Gas and Oil Equipment Directory

1.2 GENERAL REQUIREMENTS

1.2.1 Welding

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified at least 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The Contracting Officer shall be furnished with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05090A WELDING, STRUCTURAL.

[AM#2]1.2.2 Jointing Thermoplastic Piping

Piping shall be jointed by performance qualified joiners using qualified procedures in accordance with AGA Manual. Plastic Pipe Manual for Gas Service. The Contracting Officer shall be furnished with a copy of qualified procedures and list of and identification symbols of qualified joiners.

1.2.3 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years

prior to bid opening. Asbestos or products containing asbestos shall not be used. Manufacturer's descriptive data and installation instructions shall be submitted for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Valves, flanges and fittings shall be marked in accordance with MSS SP-25.

1.2.4 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

[AM#2]1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gas Piping System; G.

Drawings showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of connectors and supports.

SD-03 Product Data

Welding; G.

Qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

SD-06 Test Reports

Testing; G.

Pressure Tests; G.

Test With Gas; G.

Test reports in booklet form tabulating test and measurements performed. The reports shall be dated after award of this contract, shall state the contractor's name and address, shall name the project and location, and shall list the specific requirements which are being certified.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 Steel Pipe, Joints, and Fittings

Steel pipe shall conform to ASME B36.10M. Malleable-iron threaded fittings shall conform to ASME B16.3. Steel pipe flanges and flanged fittings including bolts, nuts, and bolt pattern shall be in accordance with ASME B16.5. Wrought steel butt welding fittings shall conform to ASME B16.9. Socket welding and threaded forged steel fittings shall conform to ASME B16.11.

2.1.2 Polyethylene Pipe, Tubing, Fittings and Joints

Polyethylene pipe, tubing, fittings and joints shall conform to ASTM D 3350 and ASTM D 2513, pipe designations PE 2406 and PE 3408, rated SDR 11 or less, as specified in ASME B31.8. Pipe sections shall be marked as required by ASTM D 2513. Butt fittings shall conform to ASTM D 3261 and socket fittings shall conform to ASTM D 2683. Fittings shall match the service rating of the pipe. Minimum wall thickness shall be based on ASME B31.8, Table 842.32.

2.1.3 Sealants for Steel Pipe Threaded Joints

Joint sealing compound shall be listed in UL Gas&Oil Dir, Class 20 or less. Tetrafluoroethylene tape shall conform to UL Gas&Oil Dir.

2.1.4 Identification

Pipe flow markings and metal tags shall be provided as required.

2.1.5 Flange Gaskets

Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 600 degree F service. NBR binder shall be used for hydrocarbon service.

2.1.6 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.1.7 Escutcheons

Escutcheons shall be chromium-plated steel or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screw.

2.1.8 Insulating Pipe Joints

2.1.8.1 Insulating Joint Material

Insulating joint material shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

2.1.8.2 Threaded Pipe Joints

Joints for threaded pipe shall be steel body nut type dielectric unions with insulating gaskets.

2.1.8.3 Flanged Pipe Joints

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts.

2.1.8.4 Dielectric Waterways and Flanges

Dielectric waterways shall have temperature and pressure rating equal to or

greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

2.1.9 Gas Transition Fittings

Gas transition fittings shall be manufactured steel fittings approved for jointing steel and polyethylene or fiberglass pipe. Approved transition fittings are those that conform to AGA Manual requirements for transition fittings.

2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

2.2.1 Valves 2 Inches and Smaller

Valves 2 inches and smaller shall conform to ASME B16.33 and shall be of materials and manufacture compatible with system materials used.

2.2.2 Valves 2-1/2 Inches and Larger

Valves 2-1/2 inches and larger shall be carbon steel conforming to API Spec 6D, Class 150.

2.3 PIPE HANGERS AND SUPPORTS

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69.

2.4 METERS, REGULATORS AND SHUTOFF VALVES

Meters, regulators and shutoff valves shall be as specified in Section 02556A GAS DISTRIBUTION SYSTEM.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2 GAS PIPING SYSTEM

Gas piping system shall be from the point of delivery, defined as the outlet of the meter set assembly, specified in Section 02556A GAS DISTRIBUTION SYSTEM, to the connections to each gas utilization device.

3.2.1 Protection of Materials and Components

Pipe and tube openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage. At the completion of all work, the entire system shall be thoroughly cleaned.

3.2.2 Workmanship and Defects

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in piping, tubing or fittings shall not be repaired. When defective piping, tubing, or fittings are located in a system, the defective material shall be replaced.

3.3 PROTECTIVE COVERING

[AM#2]3.3.1 Underground Metallic Pipe

Buried metallic piping shall be protected from corrosion with protective coatings as specified in Section 02556A GAS DISTRIBUTION SYSTEM. When dissimilar metals are joined underground, gastight insulating fittings shall be used.

3.3.2 Aboveground Metallic Piping Systems

3.3.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent cleaned. Surfaces that contain loose rust, loose mill scale and other foreign substances shall be mechanically cleaned by power wire brushing and primed with ferrous metal primer. Primed surface shall be finished with two coats of exterior vinyl paint.

3.4 INSTALLATION

Installation of the gas system shall be in conformance with the manufacturer's recommendations and applicable provisions of NFPA 54, AGA Manual, and as indicated. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable.

3.4.1 Metallic Piping Installation

Changes in direction of piping shall be made with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains.

[AM#2]3.4.2 Thermoplastic Piping, Tubing, and Fittings

Thermoplastic piping, tubing, and fittings shall be installed outside and underground only. Piping shall be buried a minimum of 18 inches below grade. The piping shall be installed to avoid excessive stresses due to thermal contraction. Thermoplastic piping shall only be allowed as indicated.

3.4.3 Connections Between Metallic and Plastic Piping

Connections shall be made only outside, underground, and with approved transition fittings.

3.4.4 Piping Buried Under Buildings

Underground piping installed beneath buildings shall be run in a steel pipe casing protected from corrosion with protective coatings as specified in Section 02556A GAS DISTRIBUTION SYSTEM. The casing shall extend at least 4 inches outside the building. The pipe shall have spacers and end bushings to seal at both ends to prevent the entrance of water and escape of gas. A vent line from the annular space shall extend above grade outside to a point where gas will not be a hazard and shall terminate in a rain- and insect-resistant fitting.

3.4.5 Concealed Piping in Buildings

When installing piping which is to be concealed, unions, tubing fittings, running threads, right- and left-hand couplings, bushings, and swing joints made by combinations of fittings shall not be used.

3.4.5.1 Piping in Partitions

Concealed piping shall be located in hollow rather than solid partitions. Tubing passing through walls or partitions shall be protected against physical damage.

3.4.6 Aboveground Piping

Aboveground piping shall be run as straight as practicable along the alignment indicated and with a minimum of joints. Piping shall be separately supported. Exposed horizontal piping shall not be installed farther than 6 inches from nearest parallel wall in laundry areas where clothes hanging could be attempted.

3.4.7 Final Gas Connections

Unless otherwise specified, final connections shall be made with rigid metallic pipe and fittings. Flexible connectors may be used for final connections to gas utilization equipment.

3.5 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

3.5.1 Threaded Metallic Joints

Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.

3.5.2 Welded Metallic Joints

Beveling, alignment, heat treatment, and inspection of welds shall conform to ASME B31.2. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected

adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

[AM#2]3.5.3 Thermoplastic Joints

Jointing procedures shall conform to AGA Manual. Solvent cement or heat of fusion joints shall not be made between different kinds of plastics.

[AM#2]3.5.4 Joining Thermoplastic to Metallic Piping or Tubing

When compression type mechanical joints are used, the gasket material in the fittings shall be compatible with the plastic piping and with the gas in the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting, and the stiffener shall be flush with end of the pipe or tubing and shall extend at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic. A split tubular stiffener shall not be used.

3.6 PIPE SLEEVES

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. All rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor or roof, and shall be cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Sleeves in mechanical room floors above grade shall extend at least 4 inches above finish floor. Unless otherwise indicated, sleeves shall be large enough to provide a minimum clearance of 1/4 inch all around the pipe. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, galvanized sheet metal with lock-type longitudinal seam. For penetrations of fire walls, fire partitions and floors which are not on grade, the annular space between the pipe and sleeve shall be sealed with firestopping material and sealant that meet the requirement of Section 07840A FIRESTOPPING.

3.7 PIPES PENETRATING WATERPROOFING MEMBRANES

Pipes penetrating waterproofing membranes shall be installed as specified in Section 15400A PLUMBING, GENERAL PURPOSE.

3.8 FIRE SEAL

Penetrations of fire rated partitions, walls and floors shall be in accordance with Section 07840A FIRESTOPPING.

3.9 ESCUTCHEONS

Escutcheons shall be provided for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.10 SPECIAL REQUIREMENTS

Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall conform to the requirements of NFPA 54.

3.11 BUILDING STRUCTURE

Building structure shall not be weakened by the installation of any gas piping. Beams or joists shall not be cut or notched.

3.12 PIPING SYSTEM SUPPORTS

Gas piping systems in buildings shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Gas piping system shall not be supported by other piping. Spacing of supports in gas piping and tubing installations shall conform to the requirements of NFPA 54. The selection and application of supports in gas piping and tubing installations shall conform to the requirements of MSS SP-69. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. The clips or clamps shall be rigidly connected to the common base member. A clearance of 1/8 inch shall be provided between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.13 ELECTRICAL BONDING AND GROUNDING

The gas piping system within the building shall be electrically continuous and bonded to a grounding electrode as required by NFPA 70. Conventional flange joints allow sufficient current flow to satisfy this requirement.

3.14 SHUTOFF VALVE

Main gas shutoff valve controlling the gas piping system shall be easily accessible for operation and shall be installed as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled.

3.15 CATHODIC PROTECTION

Cathodic protection shall be provided for underground ferrous gas piping as specified in Section 13110A CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

3.16 TESTING

Before any section of a gas piping system is put into service, it shall be carefully tested to assure that it is gastight. Prior to testing, the system shall be blown out, cleaned and cleared of all foreign material. Each joint shall be tested by means of an approved gas detector, soap and water, or an equivalent nonflammable solution. Testing shall be completed before any work is covered, enclosed, or concealed. All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage and bracing suitably designed to resist test pressures shall be installed if necessary. Oxygen shall not be used as a testing medium.

3.16.1 Pressure Tests

Before appliances are connected, piping systems shall be filled with air or an inert gas and shall withstand a minimum pressure of 3 pounds gauge for a period of not less than 10 minutes as specified in NFPA 54 without showing

any drop in pressure. Oxygen shall not be used. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device so calibrated as to be read in increments of not greater than 0.1 pound. The source of pressure shall be isolated before the pressure tests are made.

3.16.2 Test With Gas

Before turning gas under pressure into any piping, all openings from which gas can escape shall be closed. Immediately after turning on the gas, the piping system shall be checked for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. All testing shall conform to the requirements of NFPA 54. If leakage is recorded, the gas supply shall be shut off, the leak shall be repaired, and the tests repeated until all leaks have been stopped.

3.16.3 Purging

After testing is completed, and before connecting any appliances, all gas piping shall be fully purged. LPG piping tested using fuel gas with appliances connected does not require purging. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 54 are followed.

3.16.4 Labor, Materials and Equipment

All labor, materials and equipment necessary for conducting the testing and purging shall be furnished by the Contractor.

3.17 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

-- End of Section --

SECTION 15620A

LIQUID CHILLERS

06/02

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

- | | |
|-------------|------------------------------------------------------------------|
| ARI 495 | (1999) Refrigerant Liquid Receivers |
| ARI 550/590 | (1998) Water-Chilling Packages Using the Vapor Compression Cycle |
| ARI 700 | (1999) Specifications for Fluorocarbon and Other Refrigerants |

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

- | | |
|---------|------------------------------------------------------------------|
| ABMA 11 | (1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings |
| ABMA 9 | (1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|------------|------------------------------------------------------------------|
| ASTM A 307 | (2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength |
| ASTM B 117 | (1997) Operating Salt Spray (Fog) Apparatus |
| ASTM D 520 | (2000) Zinc Dust Pigment |
| ASTM E 84 | (2000a) Surface Burning Characteristics of Building Materials |
| ASTM F 104 | (1995) Nonmetallic Gasket Materials |

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

- | | |
|-----------|---------------------------------------------------------------------|
| ASHRAE 15 | (1994) Safety Code for Mechanical Refrigeration |
| ASHRAE 34 | (1997) Number Designation and Safety Classification of Refrigerants |

AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1 (1999) Safety in Welding and Cutting

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX (1998) Boiler and Pressure Vessel Code;
Section IX, Welding and Brazing
Qualifications

ASME BPVC SEC VIII D1 (1998) Boiler and Pressure Vessel Code;
Section VIII, Pressure Vessels Division 1
- Basic Coverage

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1998) Motors and Generators

NEMA MG 2 (1989) Safety Standard for Construction
and Guide for Selection, Installation, and
Use of Electric Motors and Generators

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G
Installation

Drawings, at least 5 weeks prior to beginning construction, provided in adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

- a. Equipment layouts which identify assembly and installation details.
- b. Plans and elevations which identify clearances required for maintenance and operation.
- c. Wiring diagrams which identify each component individually and all interconnected or interlocked relationships between components.
- d. Foundation drawings, bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations.
- e. Details, if piping and equipment are to be supported other than as indicated, which include loadings and type of frames, brackets, stanchions, or other supports.

SD-03 Product Data

Refrigeration System; G

Manufacturer's standard catalog data, at least 5 weeks prior to

the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. Data shall be adequate to demonstrate compliance with contract requirements as specified within the paragraphs:

- a. Liquid Chiller
- b. Chiller Components
- c. Accessories

If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

Spare Parts

Spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

Posted Instructions

Posted instructions, at least 2 weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.

Manufacturer's Multi-Year Compressor Warranty; G

Manufacturer's multi-year warranty for compressor(s) in air-cooled liquid chillers as specified.

Demonstrations

A schedule, at least 2 weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

SD-06 Test Reports

System Performance Tests; RE

Six copies of the report shall be provided in bound 8 1/2 x 11 inch booklets. The report shall document compliance with the specified performance criteria upon completion and testing of the

system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report shall also include the following information and shall be taken at least three different times at outside dry-bulb temperatures that are at least 5 degrees F apart:

- a. Date and outside weather conditions.
- b. The load on the system based on the following:
 - (1) The refrigerant used in the system.
 - (2) Condensing temperature and pressure.
 - (3) Suction temperature and pressure.
 - (4) For absorption units, the cooling water pressures and temperatures entering and exiting the absorber and condenser. Also the refrigerant solution pressures, concentrations, and temperatures at each measurable point within the system.
 - (5) Running current, voltage and proper phase sequence for each phase of all motors.
 - (6) The actual on-site setting of all operating and safety controls.
 - (7) Chilled water pressure, flow and temperature in and out of the chiller.

SD-07 Certificates

Refrigeration System

Where the system, components, or equipment are specified to comply with requirements of AGA, NFPA, ARI, ASHRAE, ASME, or UL, 1 copy of proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not have a current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

Service Organization

A certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

SD-10 Operation and Maintenance Data

Operation Manuals

Six complete copies of an operation manual in bound 8 1/2 x 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manuals

Six complete copies of maintenance manual in bound 8 1/2 x 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

1.3 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements shall be in accordance with AWS Z49.1.

1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.5.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and shall arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.6 MANUFACTURER'S MULTI-YEAR COMPRESSOR WARRANTY

The Contractor shall provide a 5 year parts and labor (includes refrigerant) manufacturer's warranty on the air-cooled chiller compressor(s). This warranty shall be directly from the chiller manufacturer to the Government and shall be in addition to the standard one-year warranty of construction. The manufacturer's warranty shall provide for the repair or replacement of

the chiller compressor(s) that become inoperative as a result of defects in material or workmanship within 5 years after the date of final acceptance. When the manufacturer determines that a compressor requires replacement, the manufacturer shall furnish new compressor(s) at no additional cost to the Government. Upon notification that a chiller compressor has failed under the terms of the warranty, the manufacturer shall respond in no more than 48 hours. Response shall mean having a manufacturer-qualified technician onsite to evaluate the extent of the needed repairs. The warranty period shall begin on the same date as final acceptance and shall continue for the full product warranty period.

1.6.1 Indexed Notebook

The Contractor shall furnish to the Contracting Officer a bound and indexed notebook containing a complete listing of all air-cooled liquid chillers covered by a manufacturer's multi-year warranty. The chiller list shall state the duration of the warranty thereof, start date of the warranty, ending date of the warranty, location of the warranted equipment, and the point of contact for fulfillment of the warranty. Point of contact shall include the name of the service representative along with the day, night, weekend, and holiday phone numbers for a service call. The completed bound and indexed notebook shall be delivered to the Contracting Office prior to final acceptance of the facility.

1.6.2 Local Service Representative

The Contractor shall furnish with each manufacturer's multi-year warranty the name, address, and telephone number (day, night, weekend, and holiday) of the service representative nearest to the location where the equipment is installed. Upon a request for service under the multi-year warranty, the service representative shall honor the warranty during the warranty period, and shall provide the services prescribed by the terms of the warranty.

1.6.3 Equipment Warranty Tags

At the time of installation, each item of manufacturer's multi-year warranted equipment shall be tagged with a durable, oil- and water-resistant tag, suitable for interior and exterior locations, resistant to solvents, abrasion, and fading due to sunlight. The tag shall be attached with copper wire or a permanent, pressure-sensitive, adhesive backing. The tag shall be installed in an easily noticed location attached to the warranted equipment. The tag for this equipment shall be similar to the following in format, and shall contain all of the listed information:

MANUFACTURER'S MULTI-YEAR WARRANTY EQUIPMENT TAG

Equipment/Product Covered: _____

Manufacturer: _____ Model No.: _____ Serial No.: _____

Warranty Period: From _____ to _____

Contract No.: _____

Warranty Contact: _____

Name: _____

Address: _____

Telephone: _____

STATION PERSONNEL SHALL PERFORM PREVENTIVE
MAINTENANCE AND OPERATIONAL MAINTENANCE

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Products shall be supported by a service organization. System components shall be environmentally suitable for the indicated locations.

2.2 NAMEPLATES

Major equipment including chillers, compressors, compressor drivers, condensers, liquid coolers, receivers, refrigerant leak detectors, heat exchanges, fans, and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates shall be durable and legible throughout equipment life and made of stainless steel. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.3 ELECTRICAL WORK

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as shown, and unless otherwise indicated, all motors of 1 horsepower and above with open, dripproof, totally enclosed, or explosion proof fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motors shall be sized for the applicable loads. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of enclosure. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.4 SELF-CONTAINED LIQUID CHILLER

Unless necessary for delivery purposes, units shall be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the factory. In lieu of delivery constraints, a chiller may be assembled, leak-tested,

charged (refrigerant and oil), and adjusted at the job site by a factory representative. Unit components delivered separately shall be sealed and charged with a nitrogen holding charge. Unit assembly shall be completed in strict accordance with manufacturer's recommendations. Chiller shall operate within capacity range and speed recommended by the manufacturer. Parts weighing 50 pounds or more which must be removed for inspection, cleaning, or repair, such as motors, gear boxes, cylinder heads, casing tops, condenser, and cooler heads, shall have lifting eyes or lugs. Chiller shall include all customary auxiliaries deemed necessary by the manufacturer for safe, controlled, automatic operation of the equipment. Chiller shall be provided with a single point wiring connection for incoming power supply. Chiller's condenser and liquid cooler shall be provided with standard water boxes with flanged connections.

2.4.1 Rotary Screw Type

Chiller shall be constructed and rated in accordance with ARI 550/590 [AM#2] at ARI standard rating point of EWT - 54 F and LWT - 44 F with 95 F ambient. Chiller shall conform to ASHRAE 15. Chiller shall have a minimum full load EER rating of [AM#2] 9.5 and a part load kW/ton rating of [AM#2] 1.12 in accordance with ARI 550/590. As a minimum, chiller shall include the following components as defined in paragraph CHILLER COMPONENTS.

- a. Refrigerant and oil
- b. Structural base
- c. Chiller refrigerant circuit
- d. Controls package
- e. Rotary screw compressor
- f. Compressor driver, electric motor
- g. Compressor driver connection
- h. Liquid cooler (evaporator)
- i. Air-cooled condenser coil
- j. Receiver
- k. Tools

2.5 CHILLER COMPONENTS

2.5.1 Refrigerant and Oil

Refrigerants shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with ASHRAE 34. Refrigerants shall meet the requirements of ARI 700 as a minimum. Refrigerants shall have an Ozone Depletion Potential (ODP) of less than or equal to 0.05.

2.5.2 Structural Base

Chiller and individual chiller components shall be provided with a factory-mounted structural steel base (welded or bolted) or support legs.

2.5.3 Chiller Refrigerant Circuit

Chiller refrigerant circuit shall be completely piped and factory leak tested. For multicompressor units, not less than 2 independent refrigerant circuits shall be provided. Circuit shall include as a minimum a combination filter and drier, combination sight glass and moisture indicator, liquid-line solenoid valve for reciprocating, an electronic or thermostatic expansion valve with external equalizer, charging ports, compressor service valves for field-serviceable compressors, and superheat adjustment.

2.5.4 Controls Package

Chiller shall be provided with a complete factory-mounted, prewired electric or microprocessor based control system. Controls package shall contain as a minimum a digital display or acceptable gauges, an on-auto-off switch, motor starters, power wiring, and control wiring. Controls package shall provide operating controls, monitoring capabilities, programmable setpoints, safety controls, and EMCS interfaces as defined below.

2.5.4.1 Operating Controls

Chiller shall be provided with the following adjustable operating controls as a minimum.

- a. Leaving chilled water temperature control
- b. Adjustable timer or automated controls to prevent a compressor from short cycling
- c. Automatic lead/lag controls (adjustable) for multi-compressor units
- d. Load limiting
- e. System capacity control to adjust the unit capacity in accordance with the system load and the programmable setpoints. Controls shall automatically re-cycle the chiller on power interruption.
- f. Startup and head pressure controls to allow system operation at all ambient temperatures down to 20 degrees F

2.5.4.2 Monitoring Capabilities

During normal operations, the control system shall be capable of monitoring and displaying the following operating parameters. Access and operation of display shall not require opening or removing any panels or doors.

- a. Entering and leaving chilled water temperatures
- b. Self diagnostic
- c. Operation status
- d. Operating hours
- e. Number of starts
- f. Compressor status (on or off)

- g. Refrigerant discharge and suction pressures
- h. Oil pressure

2.5.4.3 Programmable Setpoints

The control system shall be capable of being reprogrammed directly at the unit. The programmable setpoints shall include the following as a minimum.

- a. Leaving Chilled Water Temperature
- b. Time Clock/Calendar Date

2.5.4.4 Safety Controls with Manual Reset

Chiller shall be provided with the following safety controls which automatically shutdown the chiller and which require manual reset.

- a. Low chilled water temperature protection
- b. High condenser refrigerant discharge pressure protection
- c. Low evaporator pressure protection
- d. Chilled water flow detection
- e. High motor winding temperature protection
- f. Low oil flow protection if applicable
- g. Motor current overload and phase loss protection

2.5.4.5 Safety Controls with Automatic Reset

Chiller shall be provided with the following safety controls which automatically shutdown the chiller and which provide automatic reset.

- a. Over/under voltage protection
- b. Chilled water flow interlock
- c. Phase reversal protection

2.5.4.6 Remote Alarm

During the initiation of a safety shutdown, a chiller's control system shall be capable of activating a remote alarm bell. In coordination with the chiller, the contractor shall provide an alarm circuit (including transformer if applicable) and a minimum 4 inch diameter alarm bell. Alarm circuit shall activate bell in the event of machine shutdown due to the chiller's monitoring of safety controls. The alarm bell shall not sound for a chiller that uses low-pressure cutout as an operating control.

2.5.4.7 Energy Management Control System (EMCS) Interface

The control system shall be capable of communicating all data to a remote integrated DDC processor through a single shielded cable. The data shall include as a minimum all system operating conditions, capacity controls,

and safety shutdown conditions. The control system shall also be capable of receiving at a minimum the following operating commands.

- a. Remote Unit Start/Stop
- b. Remote Chilled Water Reset

2.5.5 Compressor(s)

2.5.5.1 Rotary Screw Compressor(s)

Compressors shall operate stably for indefinite time periods at any stage of capacity reduction without hot-gas bypass. Provision shall be made to insure proper lubrication of bearings and shaft seals on shutdown with or without electric power supply. Rotary screw compressors shall include:

- a. An open or hermetic, positive displacement, oil-injected design directly driven by the compressor driver. Compressor shall allow access to internal compressor components for repairs, inspection, and replacement of parts.
- b. Rotors which are solid steel forging with sufficient rigidity for proper operation.
- c. A maximum rotor operating speed no greater than 3600 RPM.
- d. Casings of cast iron, precision machined for minimal clearance about periphery of rotors.
- e. A lubrication system of the forced-feed type that provides oil at the proper pressure to all parts requiring lubrication.
- f. Shaft main bearings of the sleeve type with heavy duty bushings or rolling element type in accordance with ABMA 9 or ABMA 11. Bearings shall be conservatively loaded and rated for an L(10) life of not less than 200,000 hours.
- g. A differential oil pressure or flow cutout to allow the compressor to operate only when the required oil pressure or flow is provided to the bearings.
- h. A temperature- or pressure-initiated, hydraulically actuated, single-slide-valve, capacity-control system to provide minimum automatic capacity modulation from 100 percent to 15 percent.
- i. An oil separator and oil return system to remove oil entrained in the refrigerant gas and automatically return the oil to the compressor.
- j. Crankcase oil heaters controlled as recommended by the manufacturer.

2.5.6 Compressor Driver, Electric Motor

Motors, wiring, etc. shall be in accordance with paragraph ELECTRICAL WORK.

2.5.7 Liquid Cooler (Evaporator)

Cooler shall be of the shell-and-coil or shell-and-tube type design.

Condenser's refrigerant side shall be designed and factory pressure tested to comply with ASHRAE 15. Condenser's water side shall be designed and factory pressure tested for not less than 150 psi. Cooler shell shall be constructed of seamless or welded steel. Coil bundles shall be totally removable and arranged to drain completely. Tubes shall be seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Each tube shall be individually replaceable. Tubes shall be installed into carbon mild steel tube sheets by rolling. Tube baffles shall be properly spaced to provide adequate tube support and cross flow. Performance shall be based on a water velocity not less than 3 fps nor more than 12 fps and a fouling factor of $0.0001 \text{ h}(\text{ft}^2)(\text{degrees F})/\text{Btu}$.

2.5.8 Air-Cooled Condenser Coil

Condenser coil shall be of the extended-surface fin-and-tube type and shall be constructed of seamless copper tubes with compatible aluminum fins. Fins shall be soldered or mechanically bonded to the tubes and installed in a metal casing. Coils shall be circuited and sized for a minimum of 5 degrees F subcooling and full pumpdown capacity. Coil shall be factory leak and pressure tested after assembly in accordance with ASHRAE 15.

2.5.9 Receivers

Liquid receivers not already specified herein as an integral factory-mounted part of a package, shall be designed, fitted, and rated in accordance with the recommendations of ARI 495, except as modified herein. Receiver shall bear a stamp certifying compliance with ASME BPVC SEC VIII D1 and shall meet the requirements of ASHRAE 15. Inner surfaces shall be thoroughly cleaned by sandblasting or other approved means. Each receiver shall have a storage capacity not less than 20 percent in excess of that required for the fully-charged system. Each receiver shall be equipped with inlet, outlet drop pipe, drain plug, purging valve, relief valves of capacity and setting required by ASHRAE 15, and two bull's eye liquid-level sight glasses. Sight glasses shall be in the same vertical plane, 90 degrees apart, perpendicular to the axis of the receiver, and not over 3 inches horizontally from the drop pipe measured along the axis of the receiver. In lieu of bull's eye sight glass, external gauge glass with metal glass guard and automatic closing stop valves may be provided.

2.5.10 Tools

One complete set of special tools, as recommended by the manufacturer for field maintenance of the system, shall be provided. Tools shall be mounted on a tool board in the equipment room or contained in a toolbox as directed by the Contracting Officer.

2.6 ACCESSORIES

2.6.1 Refrigerant Signs

Refrigerant signs shall be a medium-weight aluminum type with a baked enamel finish. Signs shall be suitable for indoor or outdoor service. Signs shall have a white background with red letters not less than 0.5 inches in height.

2.6.1.1 Installation Identification

Each new refrigerating system shall be provided with a refrigerant sign which indicates the following as a minimum:

- a. Contractor's name.
- b. Refrigerant number and amount of refrigerant.
- c. The lubricant identity and amount.
- d. Field test pressure applied.

2.6.1.2 Controls and Piping Identification

Refrigerant systems containing more than 110 lb of refrigerant shall be provided with refrigerant signs which designate the following as a minimum:

- a. Valves or switches for controlling the refrigerant flow and the refrigerant compressor(s).
- b. Pressure limiting device(s).

2.6.2 Gaskets

Gaskets shall conform to ASTM F 104 - classification for compressed sheet with nitrile binder and acrylic fibers for maximum 700 degrees F service.

2.6.3 Bolts and Nuts

Bolts and nuts, except as required for piping applications, shall be in accordance with ASTM A 307. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A 307.

2.7 FABRICATION

2.7.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 125 hours exposure to the salt spray test specified in ASTM B 117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

2.7.2 Factory Applied Insulation

Chiller shall be provided with factory installed insulation on surfaces subject to sweating including the liquid cooler, suction line piping, economizer, and cooling lines. Insulation on heads of coolers may be field applied, however it shall be installed to provide easy removal and replacement of heads without damage to the insulation. Where motors are the gas-cooled type, factory installed insulation shall be provided on the cold-gas inlet connection to the motor per manufacturer's standard practice. Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors shall have a flame spread index no higher than 75 and a smoke developed

index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

2.8 SUPPLEMENTAL COMPONENTS/SERVICES

2.8.1 Chilled Water Piping and Accessories

Chilled water piping and accessories shall be provided and installed in accordance with Section 15181A CHILLED WATER PIPING AND ACCESSORIES.

2.8.2 Temperature Controls

Chiller control packages shall be fully coordinated with and integrated into Section 15951A Direct Digital Control for HVAC.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be performed in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Where equipment is specified to conform to the requirements of ASME BPVC SEC VIII D and ASME BPVC SEC IX, the design, fabrication, and installation of the system shall conform to ASME BPVC SEC VIII D1 and ASME BPVC SEC IX.

3.2 MANUFACTURER'S FIELD SERVICE

The services of a factory-trained representative shall be provided for 2 days.

3.3 CLEANING AND ADJUSTING

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions. Testing, adjusting, and balancing shall be as specified in Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.4 SYSTEM PERFORMANCE TESTS

Before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as

directed. Tests shall cover a period of not less than 48 hours for each system and shall demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points shall be installed and tightened. Any refrigerant lost during the system startup shall be replaced. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested. Tests shall be conducted in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. Field tests shall be coordinated with Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.5 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 4 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field posted instructions shall cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations.

-- End of Section --

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

08/02

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 260	(2001) Sound Rating of Ducted Air Moving and Conditioning Equipment
ARI 410	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	(1999) Central-Station Air-Handling Units
ARI 880	(1998) Air Terminals
ARI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 210	(1999) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 300	(1996) Reverberant Room Method for Sound Testing of Fans

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings

ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM C 1071	(2000) Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing

Material)

ASTM E 437 (1992; R 1997) Industrial Wire Cloth and Screens (Square Opening Series)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.1 (1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

ASHRAE 68 (1997) Laboratory Method of Testing to Determine the Sound Power in a Duct

ASHRAE 70 (1991) Method of Testing for Rating the Performance of Air Outlets and Inlets

ASME INTERNATIONAL (ASME)

ASME B31.1 (2001) Power Piping

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (1999) Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds (1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible

SMACNA Install Fire Damp HVAC (1992; 2th Printing 1996) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems

SMACNA Leakage Test Mnl (1985; 6th Printing 1997) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL 181 (1996; Rev thru Dec 1998) Factory-Made Air Ducts and Air Connectors

UL 214 (1997; Rev thru Aug 2001) Tests for Flame-Propagation of Fabrics and Films

UL 555 (1999; Rev thru Jan 2002) Fire Dampers

UL 586 (1996; Rev thru Apr 2000) High-Efficiency, Particulate, Air Filter Units

1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.4 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings
Installation; FIO

Drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-03 Product Data

Components and Equipment; FIO

Manufacturer's catalog data included with the detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

- a. Piping Components
- b. Ductwork Components

- c. Air Systems Equipment
- d. Air Handling Units
- e. Terminal Units

Diagrams; G

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Performance Tests; FIO

Proposed test schedules for hydrostatic test of piping, ductwork leak test, and performance tests, at least 2 weeks prior to the start of related testing.

Field Training

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-06 Test Reports

Performance Tests; FIO

Testing, Adjusting, and Balancing; FIO

Test reports for the piping hydrostatic test, ductwork leak test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; FIO

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year manufacturer's experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate installed by the manufacturer that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.5 PIPING COMPONENTS

2.5.1 Steel Pipe

Refer to Section 15181A.

2.6 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be according to Section 16415A ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 10 hp or less. Adjustable frequency drives shall be used for larger motors.

2.7 CONTROLS

Controls shall be provided as specified in Section 15950A HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS.

2.8 DUCTWORK COMPONENTS

2.8.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA HVAC Duct Const Stds unless otherwise specified. Elbows shall be radius type with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. 3 through 10 inch w. g. shall meet the requirements of Seal Class A. All ductwork in VAV systems upstream of the VAV boxes shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS and shall be suitable for the range of air distribution and ambient temperatures that it will be exposed to. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA HVAC Duct Const Stds. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

2.8.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.8.1.2 Insulated Nonmetallic Flexible Duct Runouts

Flexible duct runouts shall be used only where indicated. Runout length shall be as shown on the drawings, but shall in no case exceed 10 feet. Runouts shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Where coil induction or high velocity units are supplied with vertical air inlets, a streamlined and vaned and mitered elbow transition piece shall be provided for connection to the flexible duct or hose. The last elbow to these units, other than the vertical air inlet type, shall be a die-stamped elbow and not a flexible connector. Insulated flexible connectors may be used as runouts. The insulated material and vapor barrier shall conform to the requirements of Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. The insulation material surface shall not be exposed to the air stream.

2.8.1.3 General Service Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.8.2 Ductwork Accessories

2.8.2.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA HVAC Duct Const Stds. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 x 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 x 24 inches or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.8.2.2 Fire Dampers

Fire dampers shall be 1.5 hour fire rated unless otherwise indicated. Fire dampers shall conform to the requirements of NFPA 90A and UL 555. The Contractor shall perform the fire damper test as outlined in NFPA 90A. A pressure relief damper shall be provided upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then this pressure relief damper shall be factory insulated. Fire dampers shall be automatic operating type and shall have a dynamic rating suitable for the maximum air velocity and pressure differential to which it will be subjected. Fire dampers shall be approved for the specific application, and shall be installed according to their listing. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, will not impair the operation of the damper. Sleeves or frames shall be equipped with perimeter mounting angles attached on both sides of the wall or floor opening. Ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies shall be constructed in conformance with UL Fire Resist Dir. Fire dampers shall be curtain type with damper blades. Dampers shall not reduce the duct or the air transfer opening cross-sectional area. Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed. Acceptance testing of fire dampers shall be performed per paragraph Fire Damper Acceptance Test and NFPA 90A.

2.8.2.3 Smoke Dampers

All smoke dampers shall be UL qualified per latest edition of Standard

555S, Leakage Class I, 250 deg F temperature category. Blades shall be airfoil-shaped, double-skin construction, 14-gage equivalent thickness. [AM#2] Smoke damper actuator shall be a 120-volt electrical actuator that will fail closed.

2.8.2.4 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch rod brought through the side of the duct with locking setscrew and bushing.

Two rods are required on splitters over 8 inches. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.8.2.5 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

2.8.3 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.8.3.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 15 inches in diameter or less passing through floors, walls, ceilings, or roof, and installed during

construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53/A 53M, Schedule 20 shall be used. Sleeve shall provide 1 inch clearance between the duct and the sleeve or 1 inch clearance between the insulation and the sleeve for insulated ducts.

2.8.3.2 Framed Prepared Openings

Openings shall have 1 inch clearance between the duct and the opening or 1 inch clearance between the insulation and the opening for insulated ducts.

2.8.3.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 15 inches in diameter or less shall be fabricated from 20 gauge galvanized steel. Collars for round ducts larger than 15 inches and square, and rectangular ducts shall be fabricated from 18 gauge galvanized steel. Collars shall be installed with fasteners on maximum 6 inch centers, except that not less than 4 fasteners shall be used.

2.8.4 Plenums and Casings for Field-Fabricated Units

2.8.4.1 Plenum and Casings

Plenums and casings shall be fabricated and erected as shown in SMACNA HVAC Duct Const Stds, as applicable. Unless otherwise indicated, system casing shall be constructed of not less than 16 gauge galvanized sheet steel. Cooling coil drain pans with 1 inch threaded outlet shall be provided to collect condensation from the cooling coils. Drain pans shall be fabricated of not lighter than 16 gauge steel, galvanized after fabrication or of 18 gauge corrosion-resisting sheet steel conforming to ASTM A 167, Type 304, welded and stiffened. Drain pans exposed to the atmosphere shall be thermally insulated to prevent condensation. Insulation shall be coated with a flame resistant waterproofing material. Separate drain pans shall be provided for each vertical coil section, and a separate drain line shall be provided for each pan. Pans shall be generously sized to ensure capture of entrained moisture on the downstream-air side of the coil. Openings in the casing, such as for piping connections, shall be sealed and covered to prevent air leakage. Water seal for the drain shall provide at least 2 inch water gauge greater than the maximum negative pressure in the coil space.

2.8.4.2 Casing

Casings shall be terminated at the curb line and anchored by the use of galvanized angle iron sealed and bolted to the curb, as indicated in SMACNA

HVAC Duct Const Stds.

2.8.4.3 Access Doors

Access doors shall be provided in each section of the casing. Door frames shall be welded in place, and each door shall be neoprene gasketed, hinged with minimum of two brass hinges, and fastened with a minimum of two brass tension fasteners operable from inside and outside of the casing. Where possible, doors shall be 36 x 18 inches located 18 inches above the floor. Where the space available will not accommodate doors of this size, doors as large as the space will accommodate shall be provided. Doors shall swing so that fan suction or pressure holds door in closed position, and shall be airtight. A push-button station to stop the supply fan shall be located inside the casing where indicated.

2.8.4.4 Factory-Fabricated Insulated Sheet Metal Panels

Factory-fabricated components may be used for field-assembled units, provided all requirements specified for field-fabricated plenums and casings are met. Panels shall be of modular design, pretested for structural strength, thermal control, condensation control, and acoustical control. Panel joints shall be sealed and insulated access doors shall be provided and gasketed to prevent air leakage. Panel construction shall be not less than 20 gauge galvanized sheet steel and shall be assembled with fasteners treated against corrosion. Standard length panels shall deflect not more than 1/2 inch under operation. Details of construction, including joint sealing, not specifically covered shall be as indicated in SMACNA HVAC Duct Const Stds. The plenums and casings shall be constructed to withstand the specified internal pressure of the air systems.

2.8.4.5 Duct Liner

Unless otherwise specified, duct liner shall conform to ASTM C 1071, Type I or II.

2.8.5 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen according to NFPA 90A.

2.8.5.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with

air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL Elec Const Dir for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.8.5.2 Registers, Grilles and Transfer Grilles

Units shall be four-way directional-control type, except that transfer grilles, return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.8.6 Louvers

Louvers for installation in exterior walls which are associated with the air supply and distribution system shall be as specified in Section 10201 METAL WALL LOUVERS.

2.8.7 Air Vents, Penthouses, and Goosenecks

Air vents, penthouses, and goosenecks shall be fabricated from galvanized steel sheets with galvanized structural shapes. Sheet metal thickness, reinforcement, and fabrication shall conform to SMACNA HVAC Duct Const Stds.

Louver blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Air vents, penthouses, and goosenecks shall be provided with bird screen.

2.8.8 Bird Screens and Frames

Bird screens shall conform to ASTM E 437, 1/4-inch aluminum or stainless steel. Aluminum screens shall be rated "medium-light". Stainless steel screens shall be rated "light". Frames shall be removable type, or stainless steel or extruded aluminum.

2.9 AIR SYSTEMS EQUIPMENT

2.9.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 150 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 hp and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave

shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts.

Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.9.1.1 Centrifugal Fans

Centrifugal fans shall be fully enclosed, single-width single-inlet, or double-width double-inlet, AMCA Pressure Class I, II, or III as required or indicated for the design system pressure. Impeller wheels shall be rigidly constructed, accurately balanced both statically and dynamically. Fan blades may be forward curved or backward-inclined airfoil design in wheel sizes up to 30 inches. Fan blades for wheels over 30 inches in diameter shall be backward-inclined airfoil design. Fan wheels over 36 inches in diameter shall have overhung pulleys and a bearing on each side of the wheel. Fan wheels 36 inches or less in diameter may have one or more extra long bearings between the fan wheel and the drive. Bearings shall be sleeve type, self-aligning and self-oiling with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Grease fittings shall be connected to tubing and serviceable from a single accessible point. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11.

Fan shafts shall be steel, accurately finished, and shall be provided with key seats and keys for impeller hubs and fan pulleys. Each fan outlet shall be of ample proportions and shall be designed for the attachment of angles and bolts for attaching flexible connections. Motors, unless otherwise indicated, shall not exceed 1800 rpm and shall have totally enclosed enclosures.

2.9.1.2 Panel Type Power Wall Ventilators

Fans shall be propeller type, assembled on a reinforced metal panel with venturi opening spun into panel. Fans with wheels less than 24 inches in diameter shall be direct or V-belt driven and fans with wheels 24 inches diameter and larger shall be V-belt drive type. Fans shall be furnished with wall mounting collar. Lubricated bearings shall be provided. Fans shall be fitted with wheel and motor side metal or wire guards which have a corrosion-resistant finish. Motor enclosure shall be totally enclosed fan cooled type. Gravity backdraft dampers shall be provided where indicated.

2.9.1.3 Centrifugal Type Power Wall Ventilators

Fans shall be direct driven centrifugal type with backward inclined, non-overloading wheel. Motor housing shall be removable and weatherproof. Unit housing shall be designed for sealing to building surface and for discharge and condensate drippage away from building surface. Housing shall be constructed of heavy gauge aluminum. Unit shall be fitted with an aluminum wire discharge bird screen, anodized aluminum wall grille, manufacturer's standard gravity damper, an airtight and liquid-tight

metallic wall sleeve. Motor enclosure shall be totally enclosed fan cooled type. Lubricated bearings shall be provided.

2.9.1.4 Centrifugal Type Power Roof Ventilators

Fans shall be V-belt driven with backward inclined, non-overloading wheel. Motor compartment housing shall be hinged or removable and weatherproof, constructed of heavy gauge aluminum. Fans shall be provided with birdscreen, disconnect switch, gravity dampers, roof curb, and extended base. Motors enclosure shall be dripproof type. Lubricated bearings shall be provided.

2.9.1.5 Cabinet-Enclosed Supply Air Fan

a. Fan Section

(1) Casing: Fabricate a casing from galvanized steel sheets reinforced as required with structural members. Provide access panels to permit inspection and maintenance.

(2) Fan: Supply double-inlet, squirrel-cage, centrifugal fans with die-formed impeller blades. Use rigid galvanized steel or aluminum fan wheels which are statically and dynamically balanced. Mount the wheels on a common shaft and fasten the wheels mechanically to the shaft. Provide galvanized steel fan scrolls in a secured casing to prevent vibration. Design fans for quiet, slow speed operation at specified rating conditions.

(3) Shaft: Provide a shaft with adequate stiffness to prevent deflection and vibration. Rate the shaft at maximum rpm 10 percent below the first critical speed. Make a tachometer groove in the drive end of the shaft.

(4) Bearings: Install antifriction ball bearings, selected for 200,000 hours minimum average life under actual load and speed conditions. Locate the bearing to be adjustable for accurate alignment of fan wheels in scrolls. Provide remote grease fittings on the accessible side of the unit for ease of lubrication.

b. Motors: Furnish motors in accordance with the sections on Motors, and Motor Starters. Motors must have grease-lubricated ball bearings with alemite fittings. Mount the fan drive motor on a vibration isolating adjustable base, arranged for positive adjustment of drive alignment and belt tension. Select fan motors to be nonoverloading at design rpm and at static pressure 15 percent under design.

c. Belt Guard: Provide a substantial, removable belt guard for drives on the unit exterior. Leave a hole over the tachometer groove.

d. Provide bird screen on inlets around the perimeter fan housing.

2.9.2 Coils

Coils shall be fin-and-tube type constructed of seamless copper tubes and aluminum fins mechanically bonded to the tubes. Copper tube wall thickness shall be a minimum of 0.020 inches. Aluminum fins shall be 0.0075 inch minimum thickness. Casing and tube support sheets shall be not lighter

than 16 gauge galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 400 psi air pressure and shall be suitable for 200 psi working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified according to ARI 410.

2.9.2.1 Water Coils

Water coils shall be installed with a pitch of not less than 1/8 inch per foot of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.

2.9.2.2 [AM#2] Direct-Expansion Coils

[AM#2] Direct-expansion coils shall be suitable for the refrigerant involved. Suction headers shall be seamless copper tubing or seamless or resistance welded steel tube with copper connections. Supply headers shall consist of a distributor which shall distribute the refrigerant through seamless copper tubing equally to all circuits in the coil. Tubes shall be circuited to ensure minimum pressure drop and maximum heat transfer. Circuited shall permit refrigerant flow from inlet to suction outlet without causing oil slugging or restricting refrigerant flow in coil. Each coil to be field installed shall be completely dehydrated and sealed at the factory upon completion of pressure tests. DX coil shall match with Section 15700, paragraph 2.6, Remote Condenser or Condensing Units.

2.9.3 Air Filters

Air filters shall be listed according to requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method shall be as listed under the Label Service and shall meet the requirements of UL 586.

2.9.3.1 Extended Surface Pleated Panel Filters

Filters shall be 2 inch depth, sectional, disposable type of the size indicated and shall have an average efficiency of 25 to 30 percent when tested according to ASHRAE 52.1. Initial resistance at 500 feet per minute shall not exceed 0.36 inches water gauge. Filters shall be UL Class 2. Media shall be nonwoven cotton and synthetic fiber mat. A wire support grid bonded to the media shall be attached to a moisture resistant fiberboard frame. All four edges of the filter media shall be bonded to the inside of the frame to prevent air bypass and increase rigidity.

2.9.3.2 Cartridge Type Filters

Filters shall be 12 inch depth, sectional, replaceable dry media type of the size indicated and shall have an average efficiency of 80 to 85 percent when tested according to ASHRAE 52.1. Initial resistance at 500 feet per minute shall not exceed 0.56 inches, water gauge. Filters shall be UL class 1. Media shall be pleated microglass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent airflow will have no effect on filter integrity or performance. Each filter shall be installed with an extended surface pleated media panel filter as a prefilter in a factory preassembled side access housing, or a factory-made sectional frame bank, as indicated.

2.9.3.3 Holding Frames

Frames shall be fabricated from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Each holding frame shall be equipped with suitable filter holding devices. Holding frame seats shall be gasketed. All joints shall be airtight.

2.9.3.4 Filter Gauges

Filter gauges shall be dial type, diaphragm actuated draft and shall be provided for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, shall have white dials with black figures, and shall be graduated in 0.01 inch, and shall have a minimum range of 1 inch beyond the specified final resistance for the filter bank on which each gauge is applied. Each gauge shall incorporate a screw operated zero adjustment and shall be furnished complete with two static pressure taps with integral compression fittings, two molded plastic vent valves, two 5 foot minimum lengths of 1/4 inch diameter aluminum tubing, and all hardware and accessories for gauge mounting.

2.10 AIR HANDLING UNITS

2.10.1 Factory-Fabricated Air Handling Units

Units shall be single-zone draw-through type for VAV constant volume and multizone blow-through type (MZ) and blow-through triple deck types as indicated. Units shall include fans, coils, airtight insulated casing, prefilters, secondary filter sections, and diffuser sections where indicated for MZ, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, mixing box, pan, vibration-isolators, and appurtenances required for specified operation. Vibration isolators shall be as indicated. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.

2.10.1.1 Casings

Casing sections shall be 2 inch double wall type constructed of a minimum 18 gauge galvanized steel, or 18 gauge steel outer casing protected with a corrosion resistant paint finish according to paragraph FACTORY PAINTING. Inner casing of double-wall units shall be minimum 20 gauge solid galvanized steel. Casing shall be designed and constructed with an integral insulated structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 18 gauge outer and 20 gauge inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be minimum 24 inches wide and shall be the full height of the unit casing or a minimum of 6 foot, whichever is less. A minimum 8 by 8 inches sealed glass window suitable for the intended application shall be installed in all access doors in the VAV AHU. Access Sections shall be according to paragraph AIR HANDLING UNITS. Drain pan shall be double-wall insulated type constructed of 16 gauge stainless steel,

pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Drain pan shall be constructed so that the pan may be visually inspected easily including underneath the coil without removal of the coil and so that the pan may be physically cleaned completely and easily underneath the coil without removal of the coil. Casing insulation shall conform to NFPA 90A Single-wall casing sections handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Double-wall casing sections handling conditioned air shall be insulated with not less than 2 inches of the same insulation specified for single-wall casings. Foil-faced insulation shall not be an acceptable substitute for use with double wall casing. Double wall insulation must be completely sealed by inner and outer panels. Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Air handling unit casing insulation shall be uniform over the entire casing. Foil-faced insulation shall not be an acceptable substitute for use on double-wall access doors and inspections doors. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door, shall be provided in the fan and coil sections.

2.10.1.2 Heating and Cooling Coils

Coils shall be provided as specified in paragraph AIR SYSTEMS EQUIPMENT, for types indicated.

2.10.1.3 Air Filters

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated (pre-filter and final filter system).

2.10.1.4 Fans

Fans shall be double-inlet, centrifugal type with each fan in a separate scroll. Fans and shafts shall be dynamically balanced prior to installation into air handling unit, then the entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit.

Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing.

Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Belt

guards shall be the three sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by ARI Guideline D. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have open enclosures. Unit fan or fans shall be selected to produce the required capacity at the fan static pressure. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300, ASHRAE 68, or ARI 260.

2.10.1.5 Access Sections and Filter/Mixing Boxes

Access sections shall be provided where indicated and shall be furnished with access doors as shown. Access sections and filter/mixing boxes shall be constructed in a manner identical to the remainder of the unit casing and shall be equipped with access doors. Mixing boxes shall be designed to minimize air stratification and to promote thorough mixing of the air streams.

2.10.1.6 Diffuser Sections

Diffuser sections shall be furnished between the discharge of all housed supply fans and cooling coils of blow-through single zone units and filter sections of those units with high efficiency filters located immediately downstream of the air handling unit fan section. Diffuser sections shall be fabricated by the unit manufacturer in a manner identical to the remainder of the unit casing, shall be designed to be airtight under positive static pressures up to 8 inches water gauge and shall have an access door on each side for inspection purposes. Diffuser section shall contain a perforated diffusion plate, fabricated of galvanized steel, Type 316 stainless steel, aluminum, or steel treated for corrosion with manufacturer's standard corrosion-resisting finish. The diffusion plate shall be designed to accomplish uniform air flow across the down-stream coil while reducing the higher fan outlet velocity to within plus or minus 5 percent of the required face velocity of the downstream component.

2.10.1.7 Balancing Plates

Provide perforated balancing plates as required to ensure balanced airway resistance between hot and cold air circuits within the unit.

2.10.1.8 Integral Air Passages

Construct air passages and ducts so as to direct air streams from the heating and cooling coils separately to mixing dampers with minimum friction loss. Insulate partitions common to both hot and cold air passages, and seal the partition airtight.

2.10.1.9 Damper Section

Provide opposed-blade, airfoil blade with vinyl seals and metal-compressible jamb seals, interlocking dampers of heavy-gauge steel, pivoted on their longitudinal axes in stainless steel bearings. Arrange hot and cold air dampers for opposed action and secure to shafts. Provide

individual sets of hot and cold air mixing dampers for each zone in multizone units. Face areas of damper sets will be in approximate proposition to the indicated zone air quantities.

2.10.1.10 Pipe Chase (A-AHU-1)

Outdoor units shall be furnished with an external 24-inch pipe chase. Insulated pipe chase shall include adequately sized access door(s) for installation and maintenance to all piping.

2.10.1.11 Dampers

Dampers shall be as specified in paragraph CONTROLS.

2.11 TERMINAL UNITS

2.11.1 Room Fan-Coil Units

Base units shall include galvanized coil casing, coil assembly drain pan, air filter, fans, motor, fan drive, and motor switch, plus an enclosure for cabinet models and casing for concealed models. Leveling devices integral with the unit shall be provided for vertical type units. Sound power levels shall be as indicated. Sound power level data or values for these units shall be obtained according to test procedures based on ARI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models will be acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Automatic valves and controls shall be provided as specified in paragraph CONTROLS. Each unit shall be fastened securely to the building structure. Capacity of the units shall be as indicated. Room fan-coil units shall be certified as complying with ARI 440, and shall meet the requirements of UL 1995.

2.11.1.1 Enclosures

Enclosures shall be fabricated of not lighter than 18 gauge steel, reinforced and braced. Front panels of enclosures shall be removable and provided with 1/4 inch closed cell insulation or 1/2 inch thick dual density foil faced fibrous glass insulation. The exposed side shall be high density, erosion-proof material suitable for use in air streams with velocities up to 4,500 fpm. Ferrous metal surfaces shall be galvanized or factory finished with corrosion resistant enamel. Access doors or removable panels shall be provided for piping and control compartments. Duct discharge collar shall be provided for concealed models. Enclosures shall have easy access for filter replacement.

2.11.1.2 Fans

Fans shall be galvanized steel or aluminum, multiblade, centrifugal type. In lieu of metal, fans and scrolls may be non-metallic materials of suitably reinforced compounds. Fans shall be dynamically and statically balanced. Surfaces shall be smooth. Assemblies shall be accessible for maintenance. Disassembly and re-assembly shall be by means of mechanical fastening devices and not by epoxies or cements.

2.11.1.3 Coils

Coils shall be constructed of not less than 3/8 inch outside diameter

seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Coils shall be provided with not less than 1/2 inch outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Coils shall be tested hydrostatically at 300 psi or under water at 250 psi air pressure and suitable for 200 psi working pressure. Provisions shall be made for coil removal.

2.11.1.4 Drain Pans

Drain and drip pans shall be sized and located to collect all water condensed on and dripping from any item within the unit enclosure or casing. Condensate drain pans shall be designed for self-drainage to preclude the buildup of microbial slime and shall be thermally insulated to prevent condensation and constructed of not lighter than 21 gauge type 304 stainless steel or noncorrosive ABS plastic. Insulation shall have a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and shall be of a waterproof type or coated with a waterproofing material. Drain pans shall be pitched to drain and shall be designed so as to allow no standing water.

Minimum 3/4 inch NPT or 5/8 inch OD drain connection shall be provided in drain pan. Auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages, may be plastic; if metal, the auxiliary pans shall comply with the requirements specified above. Insulation at control and piping connections thereto shall extend 1 inch minimum over the auxiliary drain pan.

2.11.1.5 Manually Operated Outside Air Dampers

Manually operated outside air dampers shall be provided according to the arrangement indicated. Dampers shall be parallel airfoil type and of galvanized construction. Blades shall rotate on stainless steel or nylon sleeve bearings.

2.11.1.6 Filters

Filters shall be of the fiberglass disposable type, 1 inch thick, conforming to CID A-A-1419. Filters in each unit shall be removable without the use of tools.

2.11.1.7 Motors

Motors shall be of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Motor switch shall be one speed and off, manually operated, and shall be mounted on an identified plate adjacent to the room thermostat. In lieu of the above fan speed control, a solid-state variable-speed controller having a minimum speed reduction of 50 percent may be provided. Motors shall have permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty. Motor power consumption, shown in watts, at the fan operating speed selected to meet the specified capacity shall not exceed the following values:

Free Discharge Motors

Unit Capacity (cfm)	Maximum Power Consumption (Watts)	
	115V	230V
		277V

Free Discharge Motors			
200	70	110	90
300	100	110	110
400	170	150	150
600	180	210	220
800	240	240	230
1000	310	250	270
1200	440	400	440

High Static Motors

Unit Capacity (cfm)	Maximum Power Consumption (Watts)
200	145
300	145
400	210
600	320
800	320
1000	530
1200	530

2.11.2 Variable Air Volume (VAV) Terminal Units

VAV terminal units shall be the type, size, and capacity shown and shall be mounted in the ceiling cavity and shall be suitable for single duct system applications. Actuators and controls shall be as specified in paragraph CONTROLS. Unit enclosures shall be constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge. Single discharge outlet shall be provided as required. Units with flow limiters are not acceptable. Unit air volume shall be factory preset and readily field adjustable without special tools. Reheat coils shall be provided as indicated. A flow chart shall be attached to each unit. Acoustic performance of the terminal units shall be based upon units tested according to ARI 880. Sound power level shall be as indicated. Discharge sound power shall be shown for minimum and 1-1/2 inches water gauge inlet static pressure. Acoustical lining shall be according to NFPA 90A.

2.11.2.1 Constant Volume, Single Duct

Constant volume, single duct, terminal units shall contain within the casing, a mechanical or pneumatic constant volume regulator. Volume regulators shall control air delivery to within plus or minus 5 percent of specified air flow subjected to inlet pressure from 3/4 to 6 inch water gauge.

2.11.2.2 Variable Volume, Single Duct

Variable volume, single duct, terminal units shall be provided with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Units shall control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge. Internal resistance of units shall not exceed 0.4 inch water gauge at maximum flow range. External differential pressure taps separate from the control pressure taps shall be provided for air flow measurement with a 0 to 1 inch water gauge range. Unit volume controller shall be normally open upon loss of DDC signal.

2.11.2.3 Reheat Units

a. Hot Water Coils: Hot-water coils shall be fin-and-tube type constructed of seamless copper tubes and copper or aluminum fins mechanically bonded or soldered to the tubes. Headers shall be constructed of cast iron, welded steel or copper. Casing and tube support sheets shall be 16 gauge, galvanized steel, formed to provide structural strength. Tubes shall be correctly circuited for proper water velocity without excessive pressure drop and they shall be drainable where required or indicated. At the factory, each coil shall be tested at not less than 250 psi air pressure and shall be suitable for 200 psi working pressure. Drainable coils shall be installed in the air handling units with a pitch of not less than 1/8 inch per foot of tube length toward the drain end. Coils shall conform to the provisions of ARI 410.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Piping

Pipe and fitting installation shall conform to the requirements of ASME B31.1. Pipe shall be cut accurately to measurements established at the jobsite, and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe or tubing shall be cut square, shall have burrs removed by reaming, and shall permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers. Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted. Horizontal supply mains shall pitch down in the direction of flow as indicated. The grade shall be not less than 1 inch in 40 feet. Reducing fittings shall be used for changes in pipe sizes. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the system. Pipe not otherwise specified shall be uncoated. Connections to appliances shall be made with malleable iron unions for steel pipe 2-1/2 inches or less in diameter, and with flanges for pipe 3 inches and larger. Connections between ferrous and copper piping shall be electrically isolated from each other with dielectric unions or flanges. All piping located in air plenums shall conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs shall be welded.

3.1.1.1 Joints

a. Threaded Joints: Threaded joints shall be made with tapered threads and made tight with a stiff mixture of graphite and oil or polytetrafluoroethylene tape or equivalent thread joint compound or material, applied to the male threads only.

b. Soldered Joints: Joints in copper tubing shall be cut square

with ends reamed, and all filings and dust wiped from interior of pipe. Joints shall be soldered with 95/5 solder or brazed with silver solder applied and drawn through the full fitting length. Care shall be taken to prevent annealing of tube or fittings when making connections. Joints 2-1/2 inches and larger shall be made with heat uniformly around the entire circumference of the joint with a multi-flame torch. Connections in floor slabs shall be brazed. Excess solder shall be wiped from joint before solder hardens. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B 813.

c. Welded Joints : Welding shall be according to qualified procedures using qualified welders and welding operators. Procedures and welders shall be qualified according to ASME BPVC IX.

Welding procedures qualified by others and welders and welding operators qualified by another operator may be permitted by ASME B31.1. Structural members shall be welded according to Section 05090A WELDING, STRUCTURAL. All welds shall be permanently identified by imprinting the welder's or welding operator's assigned symbol adjacent to the weld. Welded joints shall be fusion welded unless otherwise required. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connections may be made with either welding tees or branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. Electrodes shall be stored and dried according to AWS D1.1 or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.1.2 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.1.1.3 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items.

3.1.2 Supports

3.1.2.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers.

3.1.2.2 Pipe Hangers, Inserts and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein. Types 5, 12, and 26 shall not be used.

- a. Hangers: Type 3 shall not be used on insulated piping.
- b. Inserts: Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.
- c. C-Clamps: Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- d. Angle Attachments: Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- e. Hangers: Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- f. Type 39 saddles shall be used on all insulated pipe 4 inches and larger when the temperature of the medium is above 60 degrees F. Type 39 saddles shall be welded to the pipe.
- g. Type 40 shields shall:
 - (1) be used on all insulated pipes less than 4 inches.
 - (2) be used on all insulated pipes 4 inches and larger when the temperature of the medium is 60 degrees F or less.
 - (3) have a high density insert for pipe 2 inches and larger, and for smaller pipe when the insulation shows signs of being visibly compressed, or when the insulation or jacket shows visible signs of distortion at or near the type 40 shield. High density inserts shall have a density of 9 pcf or greater.
- h. Horizontal Pipe Supports: Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Pipe hanger loads suspended from steel joist with hanger loads between panel points in excess of 50 pounds shall have the excess hanger loads suspended from panel points.

i. Vertical Pipe Supports: Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

j. Insulated Pipe: Insulation on horizontal pipe shall be continuous through hangers for hot and cold piping. Other requirements on insulated pipe are specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.3 Pipe Sleeves

Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Unless otherwise indicated, sleeves shall provide a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacket over insulation and sleeves. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe or cast iron pipe. Sleeves in non-bearing walls, floors, or ceilings may be steel pipe, cast iron pipe, galvanized sheet metal with lock-type longitudinal seam and of the metal thickness indicated, or moisture resistant fiber or plastic. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve, in non-fire rated walls, shall be sealed as indicated and specified in Section 07900A JOINT SEALING. Pipes passing through wall waterproofing membrane shall be sleeved as specified above, and a waterproofing clamping flange shall be installed as indicated.

3.1.3.1 Roof and Floor Sleeves

Pipes passing through roof or floor waterproofing membrane shall be installed through a 17-ounce copper sleeve or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange. Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a troweled coating of bituminous cement. Unless otherwise shown, the flashing sleeve shall extend up the pipe a minimum of 2 inches above highest floor level or a minimum of 10 inches above the roof. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Pipes up to and including 10 inches in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess. In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as

recommended by the manufacturer to fit the pipe/conduit and sleeve involved.

3.1.3.2 Fire Seal

Where pipes pass through firewalls, fire partitions, or floors, a fire seal shall be provided as specified in Section 07840A FIRESTOPPING.

3.1.3.3 Escutcheons

Escutcheons shall be provided at finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheons shall be secured to pipe or pipe covering.

3.1.4 Condensate Drain Lines

Water seals shall be provided in the condensate drain from all units. The depth of each seal shall be 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Water seals shall be constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Pipe cap or plug cleanouts shall be provided where indicated. Drains indicated to connect to the sanitary waste system shall be connected by an indirect waste fitting. Air conditioner drain lines shall be insulated as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.5 Air Vents and Drains

3.1.5.1 Vents

Air vents shall be provided at high points, on water coils, and where indicated to ensure adequate venting of the piping system.

3.1.5.2 Drains

Drains shall be provided at low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps or plugged tees unless otherwise indicated.

3.1.6 Valves

Isolation gate or ball valves shall be installed on each side of each piece of equipment such as pumps, heaters, heating or cooling coils, and other similar items, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purposes. Isolation valves may be omitted where balancing cocks are installed to provide both balancing and isolation functions. Each valve except check valves shall be identified. Valves in horizontal lines shall be installed with stems horizontal or above.

3.1.7 Equipment and Installation

Frames and supports shall be provided for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Air handling units shall be floor mounted or ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 6 inch concrete pads or curbs doweled in place.

Concrete foundations for circulating pumps shall be heavy enough to minimize the intensity of the vibrations transmitted to the piping and the surrounding structure, as recommended in writing by the pump manufacturer. In lieu of a concrete pad foundation, a concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. The concrete foundation or concrete pedestal block shall be of a mass not less than three times the weight of the components to be supported. Lines connected to the pump mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.8 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500A MISCELLANEOUS METALS.

3.1.9 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

3.1.10 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07840A FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07900A JOINT SEALING.

3.1.11 Metal Ductwork

Installation shall be according to SMACNA HVAC Duct Const Stds unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC Duct Const Stds, unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC Duct Const Stds shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.12 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air reaches the

conditioning unit.

3.1.13 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.1.14 Power Roof Ventilator Mounting

Foamed 1/2 inch thick, closed-cell, flexible elastomer insulation shall cover width of roof curb mounting flange. Where wood nailers are used, holes shall be pre-drilled for fasteners.

3.1.15 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.2 FIELD PAINTING AND IDENTIFICATION SYSTEMS

3.2.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number shall be installed on all valves and dampers. Tags shall be 1-3/8 inch minimum diameter and marking shall be stamped or engraved. Indentations shall be black for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.2.2 Finish Painting and Pipe Color Code Marking

Finish painting of items only primed at the factory, surfaces not specifically noted otherwise, and color code marking for piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.3 DUCTWORK LEAK TEST

Ductwork leak test shall be performed for the entire air distribution and exhaust system, including fans and coils. Test procedure, apparatus, and report shall conform to SMACNA Leakage Test Mnl. The maximum allowable leakage rate is 1 percent. Ductwork leak test shall be completed with satisfactory results prior to applying insulation to ductwork exterior.

3.4 DAMPER ACCEPTANCE TEST

All fire dampers and smoke dampers shall be operated under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Fire dampers equipped with fusible links shall be tested by having the fusible link cut in place. Dynamic fire dampers shall be tested with the air handling and distribution system running. All fire dampers shall be reset with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, the damper must be installed so it is square and free from racking.

3.5 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.6 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 1 day for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.7 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Inside of room fan-coil units, air terminal units, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.8 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 16526A

AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS

08/01

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C119.1 (1986; R 1997) Sealed Insulated
Underground Connector Systems Rated 600
Volts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M (2000) Zinc (Hot-Dip Galvanized) Coatings
on Iron and Steel Products

ASTM A 153/A 153M (2000) Zinc Coating (Hot Dip) on Iron and
Steel Hardware

ASTM A 780 (2000) Repair of Damaged and Uncoated
areas of Hot-Dipped Galvanized Coatings

ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus

ASTM D 709 (2000) Laminated Thermosetting Materials

ASTM D 1248 (2000) Polyethylene Plastics Molding and
Extrusion Materials

ASTM D 1654 (1992) Evaluation of Painted or Coated
Specimens Subjected to Corrosive
Environments

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (1998) Approval Guide Fire Protection

FM P7825b (1998) Approval Guide Electrical Equipment

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1 (Rev J) Obstruction Marking and Lighting

FAA AC 150/5345-7 (Rev D; Change 1) L-824 Underground
Electrical Cable for Airport Lighting
Circuits

FAA AC 150/5345-10 (Rev E) Constant Current Regulators

Regulator Monitors

FAA AC 150/5345-26	(Rev B; Changes 1 & 2) L-823 Plug and Receptacle, Cable Connectors
FAA AC 150/5345-42	(Rev C; Change 1) Airport Light Bases, Transformer Houses, Junction Boxes and Accessories
FAA AC 150/5345-43	(Rev E) Obstruction Lighting Equipment
FAA AC 150/5345-44	(Rev F) Taxiway and Runway Signs
FAA AC 150/5345-45	(Rev A) Lightweight Approach Light Structure
FAA AC 150/5345-46	(Rev B) Runway and Taxiway Light Fixtures
FAA AC 150/5345-47	(Rev A) Isolation Transformers for Airport Lighting Systems
FAA AC 150/5370-10	(Rev A; Changes 1 thru 11) Specifying Construction of Airports
FAA DWG C-6046	(1978) Frangible Coupling Type I and Type 1A, Details
FAA E-2159	(Rev D; Amend 1) Runway End Identifier Lighting System (REIL) with Remote Monitoring Subsystem
FAA E-2325	(Rev D) Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR)
FAA E-2702	(1979) (REV A) Low Impact Resistant Structures

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE C62.11	(1999) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 48	(1998) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LA 1	(1992) Surge Arresters
NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

- NEMA WC 7 (1988; Rev 3 1996)
Cross-Linked-Thermosetting-Polyethylene-Insulated
Wire and Cable for the Transmission and
Distribution of Electrical Energy
- NEMA WC 8 (1988; Rev 3 1996)
Ethylene-Propylene-Rubber-Insulated Wire
and Cable for the Transmission and
Distribution of Electrical Energy
- NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
- NFPA 70 [AMN#0002](2002) National Electrical Code
- U.S. DEPARTMENT OF AGRICULTURE (USDA)
- REA Bull 1753F-205 (1993) Filled Telephone Cables
- THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)
- SSPC Paint 20 (1991) Zinc-Rich Primers (Type I -
"Inorganic" and Type II - "Organic")
- UNDERWRITERS LABORATORIES (UL)
- UL 1 (2000) Flexible Metal Conduit
- UL 6 (1997) Rigid Metal Conduit
- UL 44 (1999) Thermoset-Insulated Wires and Cables
- UL 360 (1996; Rev thru Oct 1997) Liquid-Tight
Flexible Steel Conduit
- UL 486A (1991; Rev thru Dec 1998) Wire Connectors
and Soldering Lugs for Use with Copper
Conductors
- UL 486B (1997; Rev Jun 1997) Wire Connectors for
Use with Aluminum Conductors
- UL 510 (1994; Rev thru Apr 1998) Polyvinyl
Chloride, Polyethylene, and Rubber
Insulating Tape
- UL 514A (1996; Rev Dec 1999) Metallic Outlet Boxes
- UL 797 (1993; Rev thru Mar 1997) Electrical
Metallic Tubing
- UL 1242 (1996; Rev Mar 1998) Intermediate Metal
Conduit
- UL Elec Const Dir (1999) Electrical Construction Equipment
Directory

1.2 GENERAL REQUIREMENTS

Items of the same classification shall be identical including equipment, assemblies, parts, and components.

1.2.1 Code Compliance

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 and local codes where required.

1.2.2 Standard Product

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.3 Prevention of Corrosion

1.2.3.1 Metallic Materials

Metallic materials shall be protected against corrosion as specified. Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

1.2.3.2 Ferrous Metal Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 123/A 123M and ASTM A 153/A 153M.

1.2.3.3 Luminaires Fabricated from Ferrous Metals

Luminaires fabricated from ferrous metals, unless hot-dip galvanized or of porcelain enamel finish shall be factory finished with a weather-resistant finish in accordance with paragraphs FACTORY COATING and FINISHING, except exposure shall be 200 hours. Finish color shall be the manufacturer's standard, unless otherwise indicated.

1.2.4 Unusual Service Conditions

Items furnished under this section shall be specifically suitable for the following unusual service conditions:

1.2.4.1 Other

Material or equipment to be installed underground; in handholes, manholes, or underground vaults; or in light bases, shall be suitable for submerged operation.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.3 SYSTEM DESCRIPTION

The airfield and heliport lighting and visual navigation aids shall consist of airfield and heliport lighting, obstruction lighting and marking, approach lights, runway lights, taxiway lights, runway end identifier lights,

runway distance markers, taxiway signs and the lighting power supply and control.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting and Navigation Aids; G.

Coordination drawings consisting of composite drawings showing coordination of work of one trade with that of other trades and with the structural and architectural elements of the work. Drawings shall be in sufficient detail to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Drawings shall indicate where conflicts or clearance problems exist between the various trades.

As-Built Drawings; G.

Drawings that provide current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible, shall be provided as instructed. The as-built drawings shall show installations with respect to fixed installations not associated with the systems specified herein. Cable and wire shall be accurately identified as to direct-burial or in conduit and shall locate the connection and routing to and away from bases, housings, and boxes.

SD-03 Product Data

Materials and Equipment; G.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each itemization shall include an item number, the quantity of items proposed, and the name of the manufacturer. Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

Protection Plan; G.

Detailed procedures to prevent damage to existing facilities or infrastructures. If damage does occur, the procedures shall address repair and replacement of damaged property at the Contractor's expense.

Training; G,

Information describing training to be provided, training aids to be used, samples of training materials to be provided, and schedules of training, three weeks before training is scheduled to begin.

Special Tools; G.

List of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

Parts; G.

A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delays.

Repair Requirements; G.

Instructions necessary to check out, troubleshoot, repair, and replace components of the systems, including integrated electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting after acceptance of the system shall be provided.

Posted Instructions; G,

A typed copy of the proposed posted instructions showing wiring, control diagrams, complete layout and operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting.

SD-06 Test Reports

Field Quality Control; G.

Upon completion and testing of the installed system, performance test reports are required in booklet form showing all field tests performed to adjust each component and all field tests performed to provide compliance with the specified performance criteria. Each test shall indicate the final position of controls.

Field test reports shall be written, signed and provided as each circuit or installation item is completed. Field tests shall include resistance-to-ground and resistance between conductors, and continuity measurements for each circuit. For each series circuit the input voltage and output current of the constant current regulator at each intensity shall be measured. For multiple circuits the input and output voltage of the transformer for each intensity setting shall be measured. A visual inspection of the lights operation, or of the markings appearance, or of the installation of fixtures or units installed shall be reported.

Inspection; G.

Inspection reports shall be prepared and provided as each stage of installation is completed. These reports shall identify the activity by contract number, location, quantity of material placed, and compliance with requirements.

SD-07 Certificates

; Qualifications;.

Certifications, when specified or required, including Certification of the Qualifications of Medium-Voltage Cable Installers, Certified Factory and Field Test Reports, and Certificates of Compliance submitted in lieu of other proofs of compliance with these contract provisions. A certification that contains the names and the qualifications of persons recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract shall be included. The certification shall indicate that any person recommended to perform actual splicing and termination has been adequately trained in the proper techniques and has had at least 3 recent years of experience in splicing and terminating the same or similar types of cables approved for installation. Any person recommended by the Contractor may be required to perform a dummy or practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types. The certification shall be prepared in conformance with paragraph CERTIFICATES OF COMPLIANCE in the SPECIAL CONTRACT REQUIREMENTS, and shall be accompanied by satisfactory proof of the training and experience of persons recommended by the Contractor as cable installers. The SF sub 6 gas pressurized cable and conduit system installer must be trained and certified in installation of this type of system and must be approved by the manufacturer of the system.

Materials and Equipment; G.

When equipment or materials are specified to conform to the standards or publications and requirements of AASHTO, ANSI, ASTM, AEIC, FM, IEEE, IES, NEMA, NFPA, or UL, or to an FAA, FS, or MS, proof that the items furnished under this section of the specifications conform to the specified requirements shall be included. The label or listing in UL Elec Const Dir or in FM P7825a, FM P7825b or the manufacturer's certification or published catalog specification data statement that the items comply with applicable specifications, standards, or publications and with the manufacturer's standards will be acceptable evidence of such compliance. Certificates shall be prepared by the manufacturer when the manufacturer's published data or drawings do not indicate conformance with other requirements of these specifications.

SD-10 Operation and Maintenance Data

Equipment; G.

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set shall be furnished prior to performance testing and the remainder shall be furnished upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown.

Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include conduit and equipment layout and simplified wiring and control diagrams of the system as installed.

PART 2 PRODUCTS

2.1 MATERIALS

Equipment and materials shall be new unless indicated or specified otherwise. Materials and equipment shall be labelled when approved by Underwriters Laboratories (UL) or Factory Mutual (FM) System. Askarel and insulating liquids containing polychlorinated biphenyls (PCB's) will not be allowed in any equipment. Equipment installed below grade in vaults, manholes, and handholes shall be the submersible type.

2.1.1 Electrical Tape

Electrical tape shall be UL 510 plastic insulating tape.

2.1.2 Nameplates

Each major component of equipment shall have as a minimum the manufacturer's name, address, and catalog or style number on a nameplate securely attached to the item of equipment. Laminated plastic nameplates shall be provided for equipment, controls, and devices to identify function, and where applicable, position. Nameplates shall be 1/8 inch thick laminated cellulose paper base phenolic resin plastic conforming to ASTM D 709 sheet type, grade ES-3, white with black center core. Surface shall be a matte finish with square corners. Lettering shall be engraved into the black core. Size of nameplates shall be 1 by 2-1/2 inches minimum with minimum 1/4 inch high normal block lettering. Nameplates provided as indicated. Nameplates shall be fastened to the device with a minimum of two sheet metal screws or two rivets.

2.1.3 Conduit, Conduit Fittings, and Boxes

2.1.3.1 Rigid Steel or Intermediate Metal Conduit (IMC) and Fittings

The metal conduit and fittings shall be UL 6 and UL 1242, respectively, coated with a polyvinylchloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mils thick, conforming to NEMA RN 1.

2.1.3.2 Flexible Metal Conduit

Flexible metal conduit shall be UL 1, zinc-coated steel. UL 360 liquid-tight flexible metal conduit shall be used in wet locations.

2.1.3.3 Outlet Boxes for Use with Steel Conduit, Rigid or Flexible

These outlet boxes shall be UL 514A, cast metal with gasket closures.

2.1.3.4 Plastic Duct for Concrete Encased Burial

These ducts shall be provided as specified in Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

2.1.3.5 Plastic Conduit for Direct Burial

This plastic conduit shall be provided as specified in Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

2.1.3.6 Frangible Couplings and Adapters

These frangible couplings shall be in accordance with FAA DWG C-6046. Upper section of frangible coupling shall be provided with one of the following:

- a. Unthreaded for slip-fitter connections.
- b. 2-13/32 inch 16N-1A modified thread for nut and compression ring to secure 2 inch EMT.
- c. 2 inch 11-1/2-N.P.T. (tapered) with 7/32 inch nominal wall thickness to accept rigid conduit coupling.
- d. Frangible Couplings for specialized applications as approved.
- e. Electrical Metallic Tubing UL 797, where indicated for use with frangible couplings and adapters.

2.1.3.7 Low-Impact-Resistant Towers

Fiberglass reinforced low-impact resistant (LIR) towers shall conform to FAA E-2702FAA AC 150/5345-45. Anchor bolts, lowering devices and fixture mounting accessories shall be provided as required by tower manufacturer.

2.1.3.8 Semi-Frangible Supports

Lights supported more than 40 feet above the ground shall have a two-element structure, the lower element being a rigid structure and the upper element being a 20 foot LIR structure in accordance with FAA E-2702.

2.1.4 Wire and Cable

Conductors shall be copper except as otherwise indicated.

2.1.4.1 Conductor Sizes

Conductor size shall conform to American Wire Gage (AWG). Conductor sizes larger than No. 8 AWG shall be stranded. No. 8 AWG and smaller may be solid or stranded unless otherwise indicated.

2.1.4.2 Low Voltage Wire and Cable

UL 44, Type XHHW shall be used for secondary series lighting circuits to be installed in pavement.

2.1.4.3 Power Cables for Use in Airfield and Heliport Lighting

Power cables shall be rated 5 kV, 133 percent insulation level, with shield and jacket conforming to NEMA WC 7 for crosslinked polyethylene or NEMA WC 8 for ethylene-propylene rubber insulated cables.

2.1.4.4 Wire and Cable for Airfield and Heliport Lighting Systems

- a. Airfield and heliport lighting cable shall be FAA AC 150/5345-7, Type L-824 for crosslinked polyethylene Type C 5000-volt cable. Series airfield and heliport lighting cable shall be unshielded. Lighting cable for multiple type lighting circuits shall be shielded.
- c. Counterpoise Wire. No. 4 AWG bare stranded copper, annealed or soft drawn.
- d. Control Cable. Multiconductor type FAA AC 150/5345-7, Type C for 120 volt AC control, rated 600 volts, No. 12 AWG, and conforming to the following unless indicated otherwise. Conductors shall be color coded. The cable shall have an overall jacket rated for direct burial. .
- e. Fused Cable Connectors. Connector shall consist of a line-side receptacle and a load-side plug, each in a molded rubber form and including crimp-on fittings for the cable ends to accommodate a 250-volt cartridge-type fuse with fuse rating as indicated. Connectors in kit form shall be properly sized for the specific cable diameter involved. Completed connection shall be watertight.
- f. Cable for sequence flashing trigger circuits shall be REA Bull 1753F-205 .

2.1.4.5 Cable Tags

Cable tags for each cable or wire shall be installed at duct entrances entering or leaving manholes, handholes, and at each terminal within the lighting vault. Cable tags shall be stainless steel, bronze, lead strap, or copper strip, approximately 1/16 inch thick or hard plastic 1/8 inch thick suitable for immersion in salt water and impervious to petroleum products and shall be of sufficient length for imprinting the legend on one line using raised letters. Cable tags shall be permanently marked or stamped with letters not less than 1/4 inch in height as indicated. Two-color laminated plastic is acceptable. Plastic tags shall be dark colored with markings of light color to provide contrast so that identification can be easily read. Fastening material shall be of a type that will not deteriorate when exposed to water with a high saline content and to petroleum products.

2.1.5 Ground Rods

Ground rods shall be sectional copper-clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and not more than 10 feet long, unless indicated otherwise.

2.1.6 Lightning Arresters

These lightning arresters shall be in accordance with IEEE C62.11 and IEEE C62.41 as applicable with ratings as indicated.

2.1.7 Surge Protection

Surge protection shall be metal oxide varistors (MOV) in accordance with NEMA LA 1 for power and signal circuits with ratings as recommended by the system manufacturer.

2.1.8 Cable Connectors and Splices

Cable connectors in accordance with FAA AC 150/5345-26, Item L-823 shall be used for connections and splices appropriate for the type of cable. Other types of cable connectors and splices shall be of copper alloys for copper conductors, aluminum alloys for aluminum-composition conductors and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. For FAA Type L-824 lighting cable, connectors shall be FAA AC 150/5345-26, Type L-823.

2.1.9 Transformers

2.1.9.1 Encapsulated Isolation Transformers

These transformers shall be FAA AC 150/5345-47, Type L-830. Each transformer shall be provided with rating as shown on the contract drawings.

2.1.10 Light Bases

Light bases shall be FAA AC 150/5345-42 Type L-867 or L-868. Steel bases, Class 1, Size B shall be provided as indicated or as required to accommodate the fixture or device installed thereon if diameter is not shown.

2.1.10.1 Accessories

Base plates, cover plates, and adapter plates shall be provided to accommodate various sizes of fixtures. Bolts shall be stainless steel.

2.1.11 Sealant for Fixtures and Wires in Drilled Holes or Saw Kerfs

The sealant shall be in accordance with FAA AC 150/5370-10, Type P-606. Use FAA AC 150/5370-10, Type P-606 sealant for use in asphaltic concrete (AC) or Portland cement concrete (PCC) pavement compatible with AC pavement and having a minimum elongation of 50 percent. Formulations of Type P-606 which are compatible with PCC pavement only are prohibited.

2.1.12 Constant Current Regulator

The regulator shall be FAA AC 150/5345-10, Type L-829 with monitoring system and with ratings as indicated.

2.1.12.1 Regulator Options

Regulators shall operate on 60 Hz, have internal primary switch included, have input voltage of 480 and be controlled by 120-volt external control voltage. Five brightness steps shall be provided.

2.1.13 Lamps and Filters

Lamps shall be of size and type indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors as indicated and conforming to the specification for the light concerned or to the standard referenced.

2.1.14 Lighting Fixtures

The lighting fixtures for the airfield and heliport lighting shall be as shown in the contract drawings or as required in other contract documents.

2.1.15 Painting

As specified in Section 09900, PAINTING GENERAL.

2.2 OBSTRUCTION LIGHTING AND MARKING

Obstructions on or near the airfield shall be marked and/or lighted as shown on the contract drawings. Obstruction marker lights shall emit aviation red steady burning light as required. The light fixtures, shall be multiple-socket assembly FAA AC 150/5345-43, Type L-810. Obstruction marker lights shall be single-unit type as shown in the contract drawings.

2.3 MEDIUM-INTENSITY APPROACH LIGHTING SYSTEMS

The medium-intensity approach lights shall be as shown on the contract drawings.

2.3.1 Elevated, Medium-Intensity, Steady-Burning Fixtures

The medium-intensity, elevated, steady-burning approach lights, shall be FAA E-2325 PAR 38 lampholders with 150 watt PAR-38 spotlight lamps frangibly mounted on light bases and/or low-impact-resistant supports.

2.3.2 Sequence Flashing Lights (SFL) for Medium Intensity Lights

These elevated SFL fixtures (RAIL) shall meet the requirements of FAA E-2159 with five lights shall be as indicated on the contract drawings as an integrated part of the approach system. The SFL system shall include the fixtures, the individual power supplies, master timer and power supply, remote control, support structures, and interconnecting wiring. The SFL shall flash twice per second in sequence towards the runway threshold.

2.4 RUNWAY LIGHTING SYSTEM

Runway lights include runway distance markers, mounting structures, controls, and the associated equipment and interconnecting wiring to provide complete systems as indicated and specified herein. In-pavement light fixtures shall be able to withstand a minimum static single wheel load of 50,000 pounds.

2.4.1 Runway Distance Markers

Runway distance markers shall conform to FAA AC 150/5345-44, Type L-858B, Size 4, Style 3 with white or yellow numerals on a black background. Markers shall be provided, to withstand a static wind load of 0.28 pound per square inch, and suitable for connection to the secondary of the isolation transformers specified. Internally illuminated markers shall be provided with illumination of the face not less than 50 percent of that at rated current when the series lighting circuit is operated at the lowest brightness step. Marker housing shall be fiber reinforced epoxy, with information faces of high-impact acrylic or ultraviolet stabilized polycarbonate. The power supply and lamps shall be Style 3, Class 1.

2.5 TAXIWAY LIGHTING SYSTEMS

Taxiway lighting systems shall include edge lights guidance signs, and hold position lights and signs. These systems shall also include the associated equipment, power supplies and controls, mounting devices, and

interconnecting wiring to provide complete systems as specified.

2.5.1 Taxiway Edge Lights

Taxiway edge light shall emit aviation blue light provided by filters or globes for both airfields and heliports. The edge lights shall meet the requirements of FAA AC 150/5345-46, Type L-861, elevated, and Type L-852E, semiflush, lights.

2.5.2 Taxiway Guidance Signs

The taxiway guidance signs shall meet the requirements of FAA AC 150/5345-44, Type L-858Y for information and Type L-858R for mandatory signs. The signs shall be rated for use in 300 MPH wind gusts. The size and information on the signs shall be as shown on contract drawings. The power supply to connect to series circuits shall be as indicated on the contract drawings.

2.5.3 Hold Position Signs

The hold positions shall be marked by psigns as specified or indicated on the contract drawings. Hold position signs shall meet the requirements of FAA AC 150/5345-44, Type L-858R, with the size and information as indicated on the contract drawings.

2.6 FACTORY COATINGS

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finish shall be provided with corrosion-resistant finishes which shall withstand 200 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (Procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with zinc rich paint conforming to SSPC Paint 20 in accordance with ASTM A 780.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Circuits installed underground shall conform to the requirements of Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND, except as required herein. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2 CABLES, GENERAL REQUIREMENTS

The type of installation, size and number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Loads shall be divided as evenly as practicable on the various phases of the system. Manufacturer's written recommendations shall be furnished for each type of splice and medium-voltage cable joint and termination, and for fireproofing

application methods, and shall be approved before any work is done. Medium-voltage cable joints and terminations shall be the standard product of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Medium-voltage cable joints shall be made by qualified cable splicers. Compounds and tapes shall be electrical grade suitable for the cable insulation provided and shall use design materials and techniques recommended by the manufacturer. Maximum length of cable pull and cable pulling tensions shall not exceed the cable manufacturer's recommendations.

3.2.1 Duct Line Installation

Cables shall be installed in duct lines. Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Cable joints in medium-voltage cables shall be made in manholes only. Neutral and ground conductors shall be installed in the same duct with their associated phase conductors. Counterpoise cable shall be installed in a separate duct or direct-burial not less than 6 inches above the uppermost duct containing electrical cable. Electrical metallic tubing shall not be installed underground or enclosed in concrete.

3.3 MEDIUM-VOLTAGE CABLES

Medium-voltage cables shall be suitable for a rated circuit voltage as indicated on the contract drawings. Other parts of the cable system such as joints and terminations shall have ratings not less than the rating of the cables on which they are installed. Separable insulated connectors shall have nominal voltage ratings coordinated to associated apparatus ratings rather than cable ratings when used to connect cable to apparatus. Cables shall be provided with 133 percent insulation level. Neutral conductors of grounded neutral systems shall be of the same insulation material as phase conductors, except that a 600-volt insulation rating is acceptable.

3.3.1 Cable Joints

Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint.

3.3.1.1 Types

Separable insulated connectors of suitable construction or standard splice kits shall be used for single-conductor and two-conductor cables. The connectors shall be of FAA AC 150/5345-26 type. Cable joints for which acceptable separable connector kits are not available may use vulcanized splices if approved.

3.3.1.2 Requirements

Cable joints shall provide insulation and jacket equivalent to that of the associated cable. Lead sleeves shall be provided for lead-covered cables. Armored cable joints shall be enclosed in compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.3.2 Terminations

Terminations shall be IEEE Std 48, Class 1 or Class 2, of the molded

elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

3.3.2.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Leakage distances shall pass the wet withstand voltage test required by IEEE Std 48 for the next higher BIL level.

3.3.2.2 Taped Terminations

Taped terminations shall use standard termination kits providing suitable terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 20 inches long from the end of the tapered cable jacket to the start of the terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

3.4 LOW-VOLTAGE CABLES

Cable shall be rated 600 volts, except that secondaries of isolation transformer to in-pavement lights installed in pavement saw kerf and 48 volt DC control cables may be 300 volts. Other parts of cable systems such as splices and terminations shall be rated at not less than 600 volts. Splices in wires No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in wires No. 8 AWG single conductor cable shall be made with FAA AC 150/5345-26 Type L-823 connectors. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

3.5 DUCT LINES

Duct lines shall be concrete-encased, thin-wall type.

3.5.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high point may be at a terminal, a manhole, a handhold, or between manholes or handholes. Manufactured 90 degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inches diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a

minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends as required, but the maximum curve shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells when duct lines terminate in manholes or handholes. Duct line markers shall be provided as indicated at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In lieu of markers, a 5 mil brightly colored plastic tape not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. After a duct line is completed, a standard flexible mandrel shall be used for cleaning followed by a brush with stiff bristles. Mandrels shall be at least 12 inches long and shall have diameters 1/4 inch less than the inside diameter of the duct being cleaned. Pneumatic rodding may be used to draw in lead wires. A coupling recommended by the duct manufacturer shall be used when an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Concrete Encasement

Each single duct shall be completely encased in concrete with a minimum of 3 inches of concrete around each duct, except that only 2 inches of concrete are required between adjacent electric power or adjacent communication ducts, and 4 inches of concrete shall be provided between adjacent electric power and communication ducts. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. At any point, except railroad crossings, tops of concrete encasements shall be not less than 18 inches below finished grade or paving. At railroad crossings, duct lines shall be encased with concrete, reinforced as indicated. Tops of concrete encasements shall be not less than 5 feet below tops of rails, unless otherwise indicated. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not further apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

3.5.4 Non-encased Direct-Burial

Top of duct lines shall be below frost line but not less than 24 inches below finished grade. Ducts shall be buried below frost line but in the earth and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones,

soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand or stone-free earth, 3 inch layers of sand or stone-free earth shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts in direct-contact tiered fashion. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 4 inch layer of backfill cover shall be sand or stone-free earth compacted as previously specified. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling. Selected earth at duct banks shall be thoroughly tamped in 4 to 6 inch layers.

3.5.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved. In the absence of specific recommendations, various types of duct joint couplings shall be made watertight as specified.

3.5.5.1 Asbestos-Cement and Bituminized-Fiber Ducts

To ensure a watertight joint, tapered ends or joints of the same material as the ducts shall be swabbed with bituminous or joint-sealing compound before couplings are applied. Plastic or nonmetallic couplings shall be tightly driven onto unswabbed ducts. Due to the brittleness of plastic couplings at low temperatures, such couplings shall not be installed when temperatures are below 0 degrees F. Couplings shall be warmed in hot water or by another approved method when installed at temperatures below 32 degrees F.

3.5.5.2 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick one-quarter-turn twist to set the joint tightly.

3.6 MANHOLES AND HANDHOLES

The manholes and handholes shall be as specified in Section 16375ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.7 WELDING

The welding of supports and metallic ducts and welding or brazing of electrical connections shall be formed by qualified welders.

3.8 CABLE MARKERS

Cable markers or tags shall be provided for each cable at duct entrances entering or leaving manholes or handholes and at each termination within the lighting vault. Cables in each manhole or handhole shall have not less than two tags per cable, one near each duct entrance hole. Immediately after cable installation, tags shall be permanently attached to cables and wires so that they cannot be accidentally detached.

3.9 FRANGIBLE REQUIREMENTS

Frangible supports, couplings, and adapters shall be installed as indicated

or specified.

3.9.1 Approach Systems Frangibility

At the 1000 foot cross bar and beyond, approach lights shall be mounted up to 6 feet above concrete foundation on threaded frangible couplings and 2 inch electrical metallic tubing (EMT). For mounting heights greater than 6 feet, approach lights shall be mounted on low-impact resistant frangible towers as indicated.

3.10 ELEVATED AIRFIELD AND HELIPORT LIGHTS

Elevated lights shall be frangibly mounted, not to exceed 14 inches in height except where higher mounting is permitted in snow accumulation areas. Equipment exceeding 14 inches in height shall be frangibly mounted as indicated.

3.11 SEMIFLUSH AIRFIELD AND HELIPORT LIGHTS

Water, debris, and other foreign substances shall be removed prior to installing semiflush light base and light. Positioning jigs shall be used to hold the light bases and/or lights to ensure correct orientation and leveling until the concrete, adhesive, or sealant can provide permanent support.

3.12 WIRES, FIXTURES, AND ENCLOSURES IN SAW KERFS AND DRILLED HOLES

3.12.1 Holes for Light Fixtures

Holes shall be bored in existing pavement to the dimensions indicated with a diamond-edged bit to provide a smooth, straight cut. Bottom of hole shall be flat or slightly concave, except that an area at least 1 inch wide around the perimeter shall be flat. Surfaces deeper than the prescribed depth shall be filled with sealant to the level of the flat area and allowed to cure before further placement.

3.12.2 Holes for Transformer Enclosures

Holes shall be drilled or excavated through concrete pavement and loose material removed. Hole shall be filled with concrete to depth indicated. A minimum of 3 inches of concrete shall be provided at bottom of hole.

3.12.3 Saw Kerfs and Splice Chambers

Saw kerfs and splice chambers shall be cut in pavements where indicated. Saw cuts shall be in straight lines with vertical sides. Width and depth of saw cuts shall be adequate for the required number of wires. Saw kerfs shall have the vertical edges chamfered at intersections. Where a saw kerf crosses a construction joint, the depth shall be increased sufficiently to allow for slack wire under the joint. The wire shall be enclosed in flexible tubing which extends not less than 2 feet each side of the joint.

3.12.4 Sandblasting

Saw kerfs, grooves, and holes shall be sandblasted to remove foreign or loose material. Sandblasting shall use approved equipment maintained in good working order. Sand for blasting shall be proper size and quality to perform the work. Nozzles for sandblasting shall be of the proper size in relation to the groove or holes to be cleaned. Nozzles enlarged by wear

shall be replaced as necessary. Sandblast air pressure shall be not less than 90 psi.

3.12.5 Cleaning

Immediately prior to installation of wire or light fixtures, saw kerfs and holes shall be flushed with a high velocity water jet or steam, and then cleaned and dried with a high velocity air jet to remove dirt, water, and foreign material.

3.12.6 Lighting Fixture Installation

Sides and bottom of each light base shall be sandblasted immediately prior to installation. Inside faces of bored hole and bottom and sides of light base shall be covered with a coating of sealant that will completely fill the void between concrete and base. A jig or holding device shall be used when installing each light fixture to ensure positioning to the proper elevation, alignment, level control, and azimuth control. Light fixture shall be oriented with the light beams parallel to the runway or taxiway centerline and facing in the required direction. Outermost edge of fixture shall be level with the surrounding pavement. Surplus sealant or flexible embedding material shall be removed. The holding device shall remain in place until sealant has reached its initial set. Fixture lead wires shall be properly arranged with respect to their connecting position. The wireway entrance into the light recess shall be blocked to retain the sealant material during curing.

3.12.7 Installation of Circuit Wires in Pavement

Wires shall be placed in saw kerfs and anchored at bottom by means of rubber or plastic wedges or noncorrosive metal clips placed every 2 or 3 feet or as often as necessary to hold the wire down. Wires crossing existing joints shall be encased in a 24 inch length of flexible tubing of polyethylene material conforming to ASTM D 1248, Type II or Type III, to break the bond between the wires and the sealing material. Flexible tubing shall be centered on the joint and of sufficient size to accommodate the wires to allow for movement of the wires as the joint opens and closes. Ends of tubing shall be wrapped with tape to prevent entrance of sealing materials. The adjacent joint area shall be packed temporarily with roving material, such as hemp, jute, cotton or flax, to prevent sealing material from flowing into the open joint. Sealing materials shall be carefully mixed and applied in accordance with the manufacturer's instructions and at the recommended temperature. Surplus or spilled material shall be removed.

3.13 SPLICES FOR AIRFIELD AND HELIPORT LIGHTING CABLE

3.13.1 Connectors

Kit type connectors shall be used to splice 5 kV single-conductor series lighting cables. During installation and prior to covering with earth, mating surfaces of connectors shall be covered until connected and clean when plugged together. At joint where connectors come together, heat shrinkable tubing shall be installed with waterproof sealant with two half-lapped layers of tape over the entire joint. Joint shall prevent entrapment of air which might subsequently loosen the joint.

3.13.2 Splicing Fixtures to the Wires in Pavement Saw Kerfs

Splices shall have preinsulated watertight connector sleeves crimped with a

tool that requires a complete crimp before tool can be removed. Splice shall be taped with plastic insulating tape.

3.14 GROUNDING SYSTEMS

3.14.1 Counterpoise Installation

Counterpoise wire shall be laid for entire length of circuits supplying airfield lighting. Wire shall be in one piece, except where distance exceeds the length usually supplied. Counterpoise shall be installed on top of the envelope of concrete-encased duct and approximately 6 inches above direct burial cables and duct lines. Where trenches or duct lines intersect, counterpoise wires shall be electrically interconnected by exothermic welding or brazing. Counterpoise to earth ground shall be connected at every 2,000 feet of cable run, at lighting vault, and at feeder connection to light circuit by means of ground rods as specified. Counterpoise shall be installed in a separate duct under roads, railroads, and paved areas above the highest duct containing electrical or communications circuits.

3.14.2 Fixture Grounding

Each fixture or group of adjacent fixtures shall be grounded by a grounding circuit separate from the counterpoise system unless required otherwise or by driven ground rods if permitted. Fixtures, steel light bases or grounding bushings on steel conduits shall be connected to an independent ground rod by a No. 6 AWG bare stranded copper wire. Semiflush fixtures for direct mounting in pavement need not be grounded. Copper wire shall be connected to ground rods by exothermic weld or brazing.

3.15 MARKING AND LIGHTING OF AIRWAY OBSTRUCTIONS

Towers, poles, smokestacks, buildings of certain shapes and sizes, and other obstructions shall be marked and lighted in accordance with FAA AC 70/7460-1 and as indicated in or required otherwise.

3.15.1 Painting of Airway Obstructions

Patterns and colors to mark obstructions shall conform to FAA AC 70/7460-1 and shall be as indicated.

3.15.2 Obstruction Marker Lights

Obstruction marker lights shall be installed on radio towers, elevated water tanks, smokestacks, buildings, and similar structures with 1 inch zinc-coated rigid steel conduit stems using standard tees and elbows, except that lowering devices, when required, shall be installed in accordance with equipment manufacturer's recommendations.

3.16 ISOLATION TRANSFORMERS

Transformer lead connections shall conform to FAA AC 150/5345-26. Transformer secondary connectors shall plug directly into a mating connector on the transformer secondary leads. During installation, mating surfaces of connectors shall be covered until connected and clean when plugged together. At joint where connectors come together, heat shrinkable tubing shall be installed with waterproof sealant or with two half-lapped layers of tape over the entire joint. Joint shall prevent entrapment of air which might subsequently loosen the joint.

3.17 TAXIWAY LIGHTING SYSTEMS

3.17.1 Taxiway Edge Lights

Edge lights shall be elevated type lights except in paved areas where semiflush lights are required. Elevated lights shall be frangibly mounted and each light supplied power through an isolation transformer. The taxiway lights shall be omnidirectional and only require leveling.

3.18 APPROACH LIGHTING SYSTEMS

Approach lighting system shall be installed as indicated or as required otherwise. Nameplates shall be provided for equipment, controls, devices, and for each lighting circuit.

3.18.1 Frangible Requirements

At the 1,000 foot crossbar and beyond, overrun lights shall be mounted up to 6 feet above concrete foundations on threaded frangible couplings and 2 inch rigid steel conduit. For mounting heights greater than 6 feet, light shall be installed on low impact-resistant (LIR) frangible supports. When rigid towers, trestles, and similar structures are required, the light unit shall be installed at least 20 feet above the rigid structure with this support unit being frangible.

3.18.2 Alignment of Lights

The approach lights shall be aligned with the axes of the beams directed towards the approach area parallel to the runway centerline. Vertically, they shall be aimed above the horizontal at the threshold of 5.5 degrees and increasing the elevation angle 0.5 degree for each 500 foot interval into the approach area from the threshold. The tolerance for vertical aiming is plus or minus 0.5 degree.

3.19 FIELD QUALITY CONTROL

The Contracting Officer shall be notified five working days prior to each test. Deficiencies found shall be corrected and tests repeated.

3.19.1 Operating Test

Each completed circuit installation shall be tested for operation. Equipment shall be demonstrated to operate in accordance with the requirements of this Section. One day and one night test shall be conducted for the Contracting Officer.

3.19.2 Distribution Conductors, 600-Volt Class

Test shall verify that no short circuits or accidental grounds exist using an instrument which applies a voltage of approximately 500 volts providing a direct reading in resistance.

3.19.3 Counterpoise System Test and Inspection

Continuity of counterpoise system shall be visually inspected at accessible locations. Continuity of counterpoise system to the vault grounding system shall be tested in manhole closest to the vault.

3.19.4 Progress Testing for Series Lighting Circuits

A megger test shall be conducted on each section of circuit or progressive combinations of sections as they are installed. Each section or progressive combination of sections shall be tested with a megohmmeter providing a voltage of approximately 1000 volts, a direct reading in resistance. Results shall be documented. Faults indicated by these tests shall be eliminated before proceeding with the circuit installation.

3.19.5 Electrical Acceptance Tests

Acceptance tests shall be performed for series and multiple airfield and heliport lighting circuits only on complete lighting circuits. Each series and multiple lighting circuit shall receive a high voltage insulation test.

3.19.5.1 Low-Voltage Continuity Tests

Each series circuit shall be tested for electrical continuity. Faults indicated by this test shall be eliminated before proceeding with the high-voltage insulation resistance test.

3.19.5.2 High-Voltage Insulation Resistance Tests

Each series lighting circuit shall be subjected to a high-voltage insulation resistance test by measurement of the insulation leakage current with a suitable high-voltage test instrument which has a steady, filtered direct current output voltage and limited current. High-voltage tester shall include an accurate voltmeter and microammeter for reading voltage applied to the circuit and resultant insulation leakage current. Voltages shall not exceed test values specified below.

- a. Test Procedure: Both leads shall be disconnected from regulator output terminals and support so that air gaps of several inches exist between bare conductors and ground. Cable sheaths shall be cleaned and dried for a distance of 1 foot from ends of cables and exposed insulation at ends of cables. Ends of both conductors of the circuit shall be connected together and to high-voltage terminals of test equipment, and test voltage applied as specified in the following tabulation between conductors and ground for a period of 5 minutes.

Series Lighting Circuits	Test Voltage, dc	
	First Test on New Circuits	Test on Existing Circuits
High Intensity Series Lighting Circuits (5,000 volt leads, 500 and 200 watt transformers)	9000	5000
Medium Intensity Series Lighting Circuits (5,000 volt leads, 30/45 watt transformers)	6000	3000

Test Voltage, dc		
Series	First Test	Test on
	on New	Existing
Lighting Circuits	Circuits	Circuits
600-Volt Circuits	1800	600

When additions are made to existing circuits, only new sections shall be tested in accordance with "First Test on New Circuits" in table above. To ensure reliable operation, complete circuit shall be tested at reduced voltages indicated above.

- b. Leakage Current: Insulation leakage current shall be measured and recorded for each circuit after a 1 minute application of the test voltage. If leakage current exceeds values specified below, the circuit shall be sectionalized and retested and the defective parts shall be repaired or replaced. Leakage current limits include allowances for the normal number of connectors and splices for each circuit as follows:

- (1) Three microamperes for each 1000 feet of cable.
- (2) Two microamperes for each 200 watt and each 500 watt 5,000-volt series transformer.
- (3) Two microamperes for each 30/45-Watt 5,000 volt series transformer.

If measured value of insulation leakage current exceeds calculated value, the circuit shall be sectionalized and tested as specified for each section. Defective components shall be repaired or replaced until repeated tests indicate an acceptable value of leakage current for the entire circuit.

3.19.6 Constant Current Regulators

Each constant current regulator shall be examined to ensure that porcelain bushings are not cracked, no shipping damage has occurred, internal and external connections are correct, switches and relays operate freely and are not tied or blocked, fuses, if required, are correct, and liquid level of liquid-filled regulators is correct. Relay panel covers shall be removed only for this examination; it is not necessary to open the main tank of liquid-filled regulators. The instructions on the plates attached to the regulators shall be followed. Covers shall be replaced tightly after completing examinations and tests.

3.19.7 Regulator Electrical Tests

Supply voltage and input tap shall correspond. With the loads disconnected, regulator shall be energized and the open circuit protector observed to ensure that it de-energizes the regulator within 3 seconds. After testing circuits for open circuit and ground fault and corrections, if any, and after determining that lamps are serviceable and in place, the loads shall be connected for each circuit or combination of circuits to be energized by the regulator and the voltage and current measured simultaneously for each brightness tap. Voltmeter and ammeter shall have an accuracy of plus or minus 1 percent of meter full scale. Readings shall be recorded during the day and night in order to obtain the average supply

voltage. Output current on each brightness tap shall be within plus or minus 2 percent full scale of the nameplate values after making necessary correction in the supply voltage. Late model regulators have automatic supply voltage correction in lieu of input taps, and output current does not change as supply voltage varies. When output current on highest intensity setting deviates from nameplate value by more than 2 percent of meter full scale and the regulator is not overloaded, internal adjustment shall be checked as described on regulator instruction plate. Since adjustment may be rather delicate, a deviation of up to plus or minus 5 percent of meter full scale is allowed for lower intensity settings before attempting to readjust the regulator.

3.19.8 Final Operating Tests

After completion of installations and the above tests, circuits, control equipment, and lights covered by the contract shall be demonstrated to be in acceptable operating condition. Each switch in the control tower lighting panels shall be operated so that each switch position is engaged at least twice. During this process, lights and associated equipment shall be observed to determine that each switch properly controls the corresponding circuit. Telephone or radio communication shall be provided between the operator and the observer. Tests shall be repeated from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Each lighting circuit shall be tested by operating the lamps at maximum brightness for not less than 30 minutes. At the beginning and at the end of this test the correct number of lights shall be observed to be burning at full brightness. One day and one night operating test shall be conducted for the Contracting Officer.

3.20 FINISHING

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as required in Section 09900 PAINTING, GENERAL.

-- End of Section --

SECTION 16527

AIRFIELD LIGHTING CONTROL AND MONITORING SYSTEM

09/2002

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 PROJECT SCOPE

1.1.1 General

[AMN#0002] Connect to an existing Distributed Computerized Control and Monitoring System (DCCMS) for airfield lighting complete with all necessary appurtenances to make the entire system complete and functional.

1.1.2 Work Includes

The work shall include all supervision, labor, software, programming, materials, tools, equipment, testing of the installation, manuals, training, and all incidentals necessary to provide a fully functional and complete system to the satisfaction of the Contracting Officer.

1.1.3 Testing and Outages

Maintain a fully functional and operational airfield lighting control system and testing of the new system. Coordinate work with the Contracting Officer to avoid conflicts with airfield operational requirements and to schedule required system outages.

1.1.4 Maintenance Warranty Agreement

Provide a one (1) year maintenance warranty agreement which shall include the furnishing of key spare parts along with technical support both remote and on site.

1.2 QUALIFICATIONS

1.2.1 [AMN#0002] "Deleted"1.2.2 [AMN#0002] "Deleted"1.3 [AMN#0002] "Deleted"1.3.1 [AMN#0002] "Deleted"1.3.2 [AMN#0002] "Deleted"

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic

designation only.

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 150/5345-3	(Rev E) L-821 Panels for Control of Airport Lighting
FAA AC 150/5345-10	(Rev E) Constant Current Regulators Regulator Monitors
FAA AC 150/5345-53B	(Addendum (03-15-00)) Airport Lighting Equipment Certification Program

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	(2000) Quality Management Systems - Requirements
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	(1993; R 2001) Industrial Control and Systems Enclosures
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1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

System Hardware; G, .

Touchscreen Control and Monitoring Functions; G, .

Major System Components; G, .

Prior to start of project construction and within 30 days of contract award, the Contractor shall submit to the Contracting Officer for approval six (6) copies of submittals containing complete dimensional and performance characteristics, system block diagram, wiring schematic diagrams, and installation and operation instructions. The block diagram shall reflect the total integration of all the new digital and analog devices into the existing system. The diagram shall reference all interconnecting cabling requirements for digital components of the system including any data communications links.

All significant equipment to be supplied shall be listed followed by descriptive data sheets. The equipment list shall include each component name, contractor, model number, a description of the operation, quantity supplied and any special setup, operation and maintenance characteristics.

Arrange, identify, and bind all submittals complete with suitable index.

Qualifications; G, .
Quality Assurance; G, .

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein and shall include the following information as a minimum: Airport; date of acceptance; contact name and phone number of airport personnel; description of hardware; description of software.

SD-06 Test Reports

Testing; G, .

Test reports showing acceptance tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings and test results.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G, .

The Contractor shall furnish eight (8) typewritten, easy-to-understand, hard cover instruction manuals suitable for daily operation and maintenance of the system. The manuals shall contain detailed instructions and well-diagrammed procedures for operations and systems maintenance. The instruction manuals shall include as a minimum the following information:

- Drawings and data sheets of major system components.
- Input/output terminal diagrams.
- Logic and block diagrams.
- Supplier-published operation and maintenance instructions on all equipment.
- Description of systems operation.
- Configuration language description.

The Contractor shall furnish an operations manual for air traffic controller use. The manual shall describe the human machine interface at the controller's workstation. The manual shall include all functions, special sequences, and maintenance details.

SD-11 Closeout Submittals

Maintenance Warranty Agreement; G, .

Provide the System's Maintenance Warranty Agreement in accordance with Part 1 Paragraph PROJECT SCOPE, subparagraph "Maintenance Warranty Agreement."

1.6 QUALITY ASSURANCE

- A. The system shall be supplied by a Contractor who is listed in the FAA Approved Equipment List, FAA AC 150/5345-53B, L-821 (FAA AC 150/5345-3)

Control Panels and who has demonstrated suitable experience in computerized airfield lighting control and monitoring systems.

B. The Contractor shall have installed at least two similar network based systems in the U.S.A. during the past year. Similar systems means network based airfield lighting control and monitoring system with fiber optic communication network using touch screen technology and a high level software language and object oriented graphic tools.

C. The Contractor shall be ISO 9001 certified by a nationally recognized certification body.

1.7 PROJECT CONDITIONS

A. This project is located on an active airfield and work is subject to security and other restrictions.

B. The airfield will be operational during construction and requires coordination and prior approval from the Contracting Officer for any planned power and systems outages. All work inside the airfield security fence shall be coordinated with the Contracting Officer.

C. The existing control and monitoring system has been provided under Phase I of this project by Crouse-Hinds. All new components required by this contract must be fully compatible with the Crouse-Hinds system already in use by the airfield.

1.8 GUARANTEE

A. The modified system shall be guaranteed to operate exactly as it did before new work began in addition to meeting or exceeding the design and performance requirements stated in this project specification.

B. Installed equipment, software, and materials which in the opinion of the Contracting Officer do not meet the design requirements shall be replaced or modified by the Contractor.

C. All equipment shall be warranted against defects in workmanship, hardware, and software for a period of twelve (12) months after system acceptance.

1.9 WORK SPECIFIED ELSEWHERE

Fiber optical cable between vaults, tower, and sequenced flasher stations, shall be single-mode fiber optical cable installed in innerduct. Cable, innerduct, and installation shall conform to Section 16711 TELEPHONE SYSTEM, OUTSIDE PLANT. Exterior duct and manhole system shall be furnished and installed as specified in Section 16526 AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS and as shown on project drawings.

1.10 Operation and Maintenance Data

Provide operation and maintenance manuals and spare parts data in accordance with Section 01770 CONTRACT CLOSEOUT and Part 1 paragraph SUBMITTALS.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 General

The airport lighting control system is the interface between the air traffic control tower operator and the airport lighting systems. It is essential that the system be reliable and that the system be simple to maintain by airport personnel. It is therefore required that the proposed DCCMS shall incorporate "open system" distributed architecture and will be easily upgradeable.

2.1.2 Distributed Nature

The system will be of a distributed nature. Communication between the various workstations will be accomplished via the airport redundant fiber optic network. An interface device to the airfield lighting shall be installed at each controllable element communicating with the system via a local redundant network. The local network shall consist of two (2) shielded twisted pairs necessary to connect the vault industrial computers with the distributed microprocessor based interface subsystem.

2.1.3 Equipment Status And Alarm Conditions

Equipment status and alarm conditions shall be transmitted to the air traffic control tower, maintenance station, and other specified locations on the airport network.

2.1.4 Built-In Computing Capacity

All the industrial computers as well as the CCR interface device shall be designed with sufficient built-in computing capacity to reduce the amount of information transmitted over the communication links. The computers shall be designed to operate as a combined system and also to independently operate emergency programs in event of a communication or component failure.

2.1.5 Fail-Safe Mode

The airport lighting control system shall be designed to revert to a fail-safe mode upon computer failure, communications failure, or loss of power. Under fail-safe conditions, airport lighting equipment that is operating at the time of failure shall continue to operate at the same intensity level. Airport lighting equipment not operating at the time of failure shall operate according to an owner-established plan.

2.1.6 Operation Monitoring

The system shall monitor the operation of the various lighting systems per AC 150/5345-10 requirements, provide alarm indications and operate the airfield lighting systems in a fail-safe mode as required.

2.2 MAJOR SYSTEM COMPONENTS

2.2.1 Touch Screens

20" Touch screens, located in the tower cab, equipment vaults and wherever else required.

2.2.2 Control And Monitoring Interface Device

Microprocessor based control and monitoring interface device with fail-safe

module for each controllable item. The control device must include mechanically latched relays as the final outputs to the controlled equipment.

2.3 SYSTEM HARDWARE AND SOFTWARE

2.3.1 Flat Screen's Touch Screen Specifications

The Touch Screen shall be of the Surface Acoustic Wave (SAW) technology that will meet the following requirements:

Mechanical

Construction: Glass panel with transducers attached to front surface of glass. Glass panel thickness nominally 0.115-inch (3 mm). Corner-mounted transducers add maximum of 0.150-inch (4 mm). Beveled flat screens have transducers attached to a beveled edge of the glass.

Positional Accuracy: Standard deviation of error should be less than ± 0.080 -inch (2 mm).

Resolution: 4096 x 4096 touch points (approximately 400 touch points per linear inch) or better.

Touch Activation Force: Typically 2 to 3 ounces (55 to 85 g).

Surface Durability: Surface durability must be that of a glass, Mohs hardness rating of 7.

Optical

Light Transmission: 90% per ASTM D1003-92.

Anti-glare surface: 6:1 minimum.

Environmental

Temperature: Operating: -20°C to 50°C .

Storage: -40°C to 71°C .

Relative Humidity: Operating: 40°C at 90% Rh, non-condensing.

Altitude: Operating: 10,000 ft (3,048 m).
Storage/transport: 50,000 ft (15,240 m).

Chemical Resistance: The touch active area of the touchscreen must be resistant to all chemicals that do not affect glass, such as Acetone, Toluene, Ammonia-based glass cleaners, Gasoline, Kerosene and Vinegar.

Electrostatic Protection: When tested per IEC 801-2 (150 pF and 150 W), the touchscreen shall withstand 20 discharges of 15 kV, distributed randomly across the active area of the touchscreen.

Agency Approvals UL Compliance:

FCC Compliance: Controllers and cables must be approved to FCC Class "A" compliance.

2.3.2 Tower Equipment

2.3.2.1 Touch Screens

Touch screen display monitors will be mounted in the tower cab console.

2.3.3 Vault Equipment

2.3.3.1 Computerized Control Interface Device

Each CCR and each controllable item shall be connected to a computerized control interface device. The interface device shall be a microprocessor based module that includes all the communication, command, input/output, and fail-safe functions. The connection of the interface device to the control system shall utilize a quick method of attachment. To simplify installation and tests, the interface device shall be factory installed on all new CCR's and selector switches. For existing CCR's and controllable items, such as a generator, the interface device shall be installed in the field and shall utilize a quick method of attachment to the network. The interface device shall not consume more than 3 watts of power and shall be connected to the CCR internal control 120 volt source. The controllable items will receive the air traffic controllers commands via the vault redundant communication network, execute the command and transfer back the status of the element to the tower, maintenance station and to any other specified locations on the airport network. All the interface devices shall use identical, interchangeable hardware. Each interface device will get its unique address downloaded via the vault redundant network and stored in a non-volatile memory. Devices requiring switches or jumpers to establish a unique address will not be accepted. Field programming shall not require any specific knowledge or background beyond familiarity with the use of computers. Each interface device shall receive data relevant to its operation, and execute the commands, utilizing a fail-safe sub-module. The fail-safe sub-module shall provide a combination of active fail-safe mode functions (automatic activation of CCRs and/or other items in case of a failure) and passive fail-safe mode functions (continued execution of the last command). Concurrent with the execution of the command, each interface device verifies the status of the CCR and circuit data and transfers the data to the control tower, maintenance station or any other specified location on the airport network. The system shall monitor the status of each command output in the vault, based on a positive back-indication from the relay outputs in the fail-safe system. The installation of the interface device shall eliminate any need for additional control or monitoring wiring between the CCR and any other point in the vault. The interface device shall perform the following functions:

- a. ON/OFF control (including brightness setting of the CCR or other controllable element).
- b. Collection of signals regarding the CCR status (voltage, current, digital data, etc.).
- c. Calculation and processing of all the signals according to FAA AC 150/5345-10, L-827 monitoring requirements (brightness, VA, wattage, burnt out lamps etc.).

- d. Fail-safe functions.
- e. Communication with the vault network.
- f. Self-diagnostic function to detect any interface device malfunction.
- g. Store local data and parameters relevant to the specific CCR. (This reduces the amount of communication required between the interface device and the industrial grade computers, which simplifies the system software and database, and increases the system reliability and maintainability).

The interface shall consist of seven (7) different sub-modules all housed on one single board:

- a. Power supply module- supplies DC voltages to the various modules of the interface device.
- b. Central processing unit with built in memory.
- c. Communication module- receives and transmits data on the vault communication network.
- d. Command output module, for controllable item switching.
- e. Fail-safe module, which insures proper operation of the CCR if the interface device fails or is disconnected.
- f. Monitoring module- monitors the status of the series circuit(s) connected to the CCR or other controllable item.
- g. Interface device erasable memory (EEPROM) for interface device address and parameters. This allows easy change of address and parameters so device can be used at any location and for any item being monitored.

Each Interface device will include the following I/O:

- a. digital outputs
- b. digital inputs
- c. analog inputs
- d. analog inputs for DC

2.3.4 Monitoring

The interface device shall provide full FAA AC 150/5345-10, L-827 or L-829 monitoring. The interface device shall be equipped with a monitoring module that provides the following information for each CCR:

- a. Loss of input power to the CCR.
- b. CCR shutdown by open-circuit/over-current protective devices.
- c. Drop of more than 10% in the CCR VA load.

- d. Failure of the CCR to deliver the selected output current.
- e. The number of burnt-out lamps in each series circuit.
- f. The circuit resistance to ground in MW.
- g. CCR status (local or remote control).
- h. The actual CCR output current.
- i. The actual CCR output voltage.
- j. The actual CCR output load (wattage).
- k. The status of the computer-controlled interposing relays that activate the CCR(commanded brightness acknowledge).

The system will include software for calibrating the following measurements:

- a. CCR operating brightness step.
- b. The number of burnt out lamp in the series circuit.
- c. The actual CCR output current.
- d. The actual CCR output voltage.
- e. The actual CCR output wattage.

2.3.5 Interface Device Display Requirement

The following LED's shall be installed on the interface device, and provide the following information.

- a. Brightness 1-5: display the commands that were sent from the interface device to the CCR. In case of unsuccessful operation (ON/OFF/brightness changing), the maintenance staff can identify whether the failure was caused by the control system (i.e., the command has not been sent by the interface device) or the problem is in the CCR (i.e. the CCR did not respond to the command). Each of the interface device interposing relays shall also include auxiliary contacts. The status of the auxiliary contacts will be sent back to the electrical vault industrial computers, and to the maintenance facility computer, to enable remote diagnosis of unsuccessful operation.
- b. L/R LED: displays the CCR control status (local or remote), as received by the interface device.
- c. LIP LED: displays an indication for a loss of input power alarm received by the interface device.
- d. RUN LED: displays the status of the interface device microprocessor.
- e. CH1 LED: displays the status of the interface device communication link, channel 1.
- f. CH2 LED: displays the status of the interface device communication link, channel 2.

2.3.6 Interface Device Programming

2.3.6.1 Address And Specific Parameters

Each interface device shall have a unique address and specific parameters, which are field-programmable. The procedure for linking an interface device with a specific CCR includes address setting and parameter loading. The address and parameters shall be set in a simple dialogue between the operator and the interface device, which does not require any specific knowledge or background beyond normal familiarity with the use of computers. Downloading of the CCR's parameters shall be done from the vault industrial computer. The control system shall continuously scan all the interface devices and detect any malfunctioning interface device as well as inconsistency between the air traffic controllers commands and the interface device's actual commands. Each interface device will transmit internal diagnostic information to the system. In case of failure the system shall provide tools for troubleshooting. The design of the interface device shall be such to permit troubleshooting of the system from any interface device. If the diagnostic program detects a malfunction in the vault network, it shall be possible to determine which unit is malfunctioning.

2.3.7 Interface Device Reliability

The interface device unit must have an actual minimum calculated MTBF of 150,000 hours. The analysis shall be presented along with a qualified independent evaluation of the analysis verifying the correctness of the MTBF calculation.

2.3.8 Fail-Safe Subsystem

2.3.8.1 Functions

Each interface device shall include a fail-safe module. The fail-safe module is a self-contained component of the system. The main functions of the fail-safe subsystem are:

- a. Insure proper operation of the airport lighting, even if the entire airport lighting control system is not functioning.
- b. Display the commands sent by the computer to the CCR's and/or to the other controllable items.
- c. Send back-indications to confirm that the commands were sent from the interface device to the CCR's and/or to the other controllable items.
- d. Permits maintenance of portions of the control system, without changing the operational status of the lighting system.

The fail-safe module shall have owner definable fail-safe modes:

a. Active Fail-Safe Mode:

If the CCR was switched ON before the failure, it will remain ON at the same brightness level.

If the CCR was switched OFF before the failure, it will switch ON to a preselected brightness level.

Passive Fail-Safe Mode (PFSM):

If the CCR was switched ON before the failure it will remain ON at the same brightness level.

If the CCR was switched OFF before the failure, it will remain OFF.

In case of unsuccessful operation of (ON/OFF/brightness changing), one shall be able to identify whether the failure was caused by the control system or the CCR . The source of failure can be identified using either of the following two (2) methods:

- a. From any industrial computer and/or the maintenance computer by comparing the tower command, the status of the interposing relay (back indication) and the CCR actual output current.
- b. Locally, by watching the LED's or other indication on the interface device. The indication will indicate if the vault computer has sent the command.

The fail-safe sub-system shall be adaptable to CCR's with either internal or external control voltage. The airport lighting control system shall enable the airport to define emergency programs to be implemented in case of communication failure between the vault and the airport network.

2.3.8.2 Technical Specifications

The fail-safe sub-system shall operate independently of the computer, providing fail-safe interfacing to constant current regulators and ON/OFF elements. The interface device shall use as final outputs electromechanical latching relays with the following characteristics:

- a. Load Side (contact closure for activation of the controllable elements) contact configuration two (2) change-over contacts:

One set used for load/switching.

One set to provide feedback to the computer on the status of the switching relay, and indicators of the command sent to the load.

- b. The contacts shall have as a minimum the following characteristics:

Switching Voltage:	250 VAC
Make Current:	8 Amps
Rated Current:	3 Amps
Break Current:	2 Amps
Operational Life:	100,000,000 operations
Contact/Volumetric Resistance:	8/35 MW
Voltage Withstand, Contact/Contact:	1000 Vrms
Voltage Withstand, Contact/Coil:	1500 Vrms
Pick-up/Drop-out/Bounce Time:	3/2/1 msec
Ambient Conditions Temperature Range:	-55° to +90°C
Thermal Resistance:	100° K/W
Shock Resistance:	50 g/Hz
Vibration Resistance:	10/2000 g/Hz
Protection:	IP67 (protection against ingress of dust and water in

Approval:

harmful quantities).
UL

2.3.8.3 Mode of Interface Operation

The commands executed by the interface device to switch the controllable elements shall be momentary commands. The commands shall be latched in the fail-safe sub-system mechanically, by means of relays. Failure of any part of the interface device shall not change the status of the airport lighting. An internal watchdog, upon detecting an interface device failure shall trigger the active fail-safe mode (AFSM). If the interface device fails, the watchdog module shall send a signal that activates the CCR, if that CCR is currently not activated.

2.3.9 Enclosures

NEMA ICS 6 unless otherwise specified.

2.4 HUMAN MACHINE INTERFACE (HMI) FUNCTIONS

The tower touchscreen display(s) shall control and monitor the airfield lighting system. The display shall show real-time information on the operational status of lighting systems. Lighting control commands are entered into the system by touching the appropriate command boxes shown on the touchscreen video display. When a command is entered, the tower touchscreen shall respond with an acknowledgment by changing the touch point color. Specific functions required and airfield graphic layout shall be as indicated on the drawings. Colors, number of screens, graphic layouts, etc. shall be as recommended by supplier and approved by the government. Any revisions during submittal review and factory test periods shall be made at no additional cost to the government. The tower touchscreen shall register the controller action as a command, generate a data instruction and transmit the command to the vault computer(s) for implementation and simultaneously to the maintenance computer and to all other specified computers connected to the airport network. The tower touchscreen shall receive confirmation from the vault(s) that the equipment has responded to the control command and display the current system status on the touchscreen display. Should the tower communications links or vault computer fail(s) an alarm shall be indicated at the maintenance computer.

2.5 TOUCHSCREEN CONTROL AND MONITORING FUNCTIONS

- a. Operation of runway light circuits consistent with airport operational requirements.
- b. Operation of taxiway light circuits consistent with airport operational requirements.
- c. Operation of REIL and PAPI system(s).
- d. Operation of airport rotating beacon.
- e. Operation of approach lights, sequenced flashers, runway guard lights, stop bar lights, arresting barriers, vehicle control lights etc.
- f. Operation of the airport emergency generator(s).
- g. Operation of hoverlane, ramp, and parking pad limit lights.

h. FAA AC 150/5345-10, L-827 monitoring for all lighting and general systems.

2.5.1 Touchscreen Command Procedure

Each command entered shall require two (2) distinct operator actions in order to initiate status changes. If the operator does not follow the required sequence, the control request shall be aborted and a CANCEL button on the display shall so indicate. Before attempting another control request the operator must touch the CANCEL button. If the operator begins a command request but fails to complete the sequence within ten (10) seconds, the request shall be automatically canceled. If the operator begins a command request and chooses not to complete the request the operator shall touch the CANCEL button to terminate the command sequence.

2.5.2 Emergency Generator Operation

The airport lighting control system shall provide manual control of the emergency generator(s) and monitor utility power status or any other parameters available and desired from the generator(s).

2.5.2.1 Utility Available Display

The utility available display shall always indicate the utility status regardless of generator status. The display background color shall be yellow when utility power is available and red when utility power is not available.

2.5.2.2 Manual Starting:

When the operator touches the GENERATOR ON display, the background color shall change to yellow. The GENERATOR OFF symbol shall change to dim blue. The airport lighting control system shall send a start command to start the generator. When the generator reaches nominal voltage, the GENERATOR AVAILABLE display background color shall change to yellow confirming generator operation.

2.5.2.3 Manual Stopping:

When the operator touches the GENERATOR OFF display, the background color shall change to high intensity blue. The GENERATOR ON display background color shall change from yellow to dim blue. The airport lighting control system shall send a stop command to stop the generator. When the generator stops, the GENERATOR AVAILABLE display background color will change from yellow to dim blue, confirming that the generator has stopped.

2.5.2.4 Automatic Mode Starting:

In addition to manual control from the airport lighting control system, the generator(s) is also controlled by the automatic transfer switch. The transfer switch monitors power status from both utility and generator sources and shall automatically start the generator when utility power fails. This operation shall be totally independent from the airport lighting control system. The appropriate display color changes shall be made to reflect the change in utility and generator status.

2.5.2.5 Automatic Mode Stopping:

After utility power is restored, the automatic transfer switch begins a

timed sequence to restore utility power. As each change of status occurs, the ALCS monitors and reports these events by displaying the appropriate colors.

2.5.2.6 Emergency Generator

The emergency generator shall operate in both manual and automatic modes as described above with automatic control having priority over the manual mode. Should the generator fail to start in either mode, the GENERATOR ON symbol shall change to red to indicate an alarm condition. The airport lighting control system shall have provisions for connection to the generator(s) and the following alarm contacts:

Low oil pressure.

Over crank (failure to start).

Low engine jacket water temperature.

High engine jacket water temperature.

Over speed.

Low fuel tank level.

2.5.3 Graphic Display and Monitoring

2.5.3.1 Display Screens

The display screens shall provide a pictorial representation of the airport runways, taxiways, approaches and other requested airport features. Screens shall be available to display the airport generator(s) and incoming power status, all maintenance monitored parameters and others as directed by the airport. All screens shall be agreed to by the supplier and government during the submittal process. When there is a change in a lighting system status the appropriate detail of the graphic shall indicate by color change the change in status.

2.5.3.2 Display Colors

Display colors shall be as follows:

Light gray - background color.

Black - basic airport features, lighting system off, circuit monitoring data missing.

Orange - runway edge lights are on.

Yellow - approach lights, PAPI's and signs are on.

Blue - taxiway edge, hoverlane lights on.

Pink - parking pad limit lights on.

Green - beacon on.

Red - alarm condition. system, inconsistency between selected and actual brightness setting.

2.5.3.3 Control Symbol Colors

Control symbol colors shall be as described in this specification.

2.5.3.4 Changes To Display Colors

The government reserves the right to require changes to the above colors at no additional cost during the submittal and factory acceptance test periods.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

The Contractor shall install all system components and appurtenances in accordance with the manufacturer's instructions and contract documents, and shall furnish necessary hardware, fixtures, cables, wire, connectors, interconnections, services, and adjustments required for a complete and operable system.

3.1.2 Current Site Conditions

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Government. The Contractor shall not take any corrective action without written permission from the Government.

3.1.3 Existing Equipment

The Contractor shall connect to and utilize existing equipment and devices as shown. The Contractor shall make written requests and obtain approval prior to disconnecting any control lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Government approval of these requests. If any device fails after the Contractor has commenced work on that device, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment. The Government is responsible for maintenance and repair of Government equipment. The Contractor shall be held responsible for repair costs due to Contractor negligence or abuse of Government equipment.

3.2 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTING, GENERAL.

3.3 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

3.4 TESTING

3.4.1 Preliminary Tests

The supplier shall provide the initial calibration and start-up of the control system by providing factory-trained personnel to perform the following:

Verify the final connections of all signal and power wiring to and from the control system.

Perform all hardware calibration and diagnostic tests, and make all necessary equipment connections.

Perform all configuration system tests, including diagnostics.

Any deficiencies found shall be corrected and system retested prior to performance of acceptance tests.

3.4.2 Acceptance Tests

Following final installation and calibration of the system, the contractor shall perform a demonstration of system performance. The Contractor shall notify the Contracting Officer at least 10 days before the acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests. Satisfactory performance shall require the system to perform control functions, monitoring and display functions, alarming, and printout functions for a period of not less than one (1) week of continuous operation.

3.5 TRAINING

The supplier shall include at the site, operator and maintenance training for one day. The training shall include operational and maintenance procedures, troubleshooting, and hands-on instructions utilizing the installed system. A period of time shall be set aside for reviewing with air traffic controllers the operation of the system.

-- End of Section --

SECTION 16710A

PREMISES DISTRIBUTION SYSTEM

09/02

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-568-B	(2001) Commercial Building Telecommunications Cabling Standard
EIA ANSI/TIA/EIA-568-B.2-1	(2002) Transmission Performance Specifications for 4-pair 100 ohm Category 6 Cabling
EIA ANSI/TIA/EIA-569-A	(2001) Commercial Building Standard for Telecommunications Pathways and Spaces
EIA ANSI/TIA/EIA-606	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
EIA ANSI/TIA/EIA-607	(1994) Commercial Building Grounding/Bonding Requirement Standard
EIA TIA/EIA-TSB-67	(1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems

IBM CORPORATION (IBM)

IBM GA27-3361-07	(1987) LAN Cabling System - Planning and Installation
IBM GA27-3773-0	(1987) Cabling System Technical Interface Specifications

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-83-596	(1994) Fiber Optic Premises Distribution Cable
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 50	(1995; Rev thru Nov 1999) Enclosures for
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Electrical Equipment

1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Premises Distribution System; G

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack details, elevation drawings of telecommunications closet walls, outlet face plate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Installation; G

Record drawings for the installed wiring system infrastructure per EIA ANSI/TIA/EIA-606. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings.

SD-03 Product Data

Record Keeping and Documentation; G

Documentation on cables and termination hardware in accordance with EIA ANSI/TIA/EIA-606.

Spare Parts

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2 months prior to the date of

beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

Manufacturer's Recommendations; G

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

Test Plan; G

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications; G

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

SD-06 Test Reports

Test Reports

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on 3-1/2 inch diskettes in ASCII format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 7 days after completion of testing.

SD-07 Certificates

Premises Distribution System

Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-B.2-1, EIA ANSI/TIA/EIA-569-A, and EIA ANSI/TIA/EIA-606 standards.

Materials and Equipment

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does

not relieve the Contractor from compliance with other requirements of the specifications.

Installers; G

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

1.5 QUALIFICATIONS

1.5.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

- a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
- c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.5.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

1.8 RECORD KEEPING AND DOCUMENTATION

1.8.1 Cables

A record of all installed cable shall be provided in hard copy format per EIA ANSI/TIA/EIA-606. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility per EIA

ANSI/TIA/EIA-606.

1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided in hard copy format per EIA ANSI/TIA/EIA-606. The hardware records shall include only the required data fields per EIA ANSI/TIA/EIA-606.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Backbone Cable

Backbone cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B for Category 3 100-ohm unshielded twisted pair cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMR per NFPA 70.

2.2.2 Horizontal Cable

Horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B.2-1 for Category 6. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMG or CMP, as appropriate, per NFPA 70.

2.2.3 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with EIA ANSI/TIA/EIA-568-B.

2.2.3.1 Telecommunications Outlets

Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies in single or double gang covers as specified in this section and as indicated on the drawings. Wall and desk outlet plates shall come equipped with two modular jacks, with the top or left jack labeled "voice" and the bottom or right jack labeled "data" and two fiber optic ST type connectors with the top or left connector labeled A and the bottom or right connector labeled B.

Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of EIA ANSI/TIA/EIA-568-B and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Modular jack pin/pair configuration shall be T568A per EIA ANSI/TIA/EIA-568-B. Modular jacks shall be unkeyed. Faceplates shall be provided and shall be ivory in color, impact resistant plastic. Mounting plates shall be provided for system furniture and shall

match the system furniture in color.

2.2.3.2 Patch Panels

Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, arranged in rows or columns on 19 inch rack mounted panels. Jack pin/pair configuration shall be T568A per EIA ANSI/TIA/EIA-568-B. Jacks shall be unkeyed. Panels shall be labeled with alphanumeric x-y coordinates. The modular jacks shall conform to the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1.

2.2.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible, twisted pair stranded wire with eight-position plugs at each end. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall be wired straight through; pin numbers shall be identical at each end and shall be paired to match T568A patch panel jack wiring per EIA ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed. Patch cords shall be factory assembled. Patch cords shall conform to the requirements of EIA ANSI/TIA/EIA-568-B.2-1 for Category 6.

2.2.3.4 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 110 which meet the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.3 SHIELDED TWISTED PAIR CABLE SYSTEM

2.3.1 Backbone Cable

Backbone cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed IBM performance requirements for Type 1A cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP per NFPA 70.

2.3.2 Horizontal Cable

Horizontal cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed IBM performance requirements for Type 1A cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP per NFPA 70.

2.3.3 Connecting Hardware

2.3.3.1 Connectors

Connectors for shielded twisted pair cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B for media interface connectors and IBM GA27-3773-0 for Type 1A data connectors. Connectors shall be of hermaphroditic design and shall be utilized for outlets and patch panel terminations. Outlet faceplates shall be provided and shall be ivory in color, impact resistant plastic. Mounting plates shall be provided for systems furniture and shall match the systems furniture in color.

2.3.3.2 Patch Panels

Patch panels shall be 19 inch rack mounted panels with openings for shielded twisted pair connectors. Panels shall be metallic and shall ground the outer shield of the cable. Patch panels shall provide strain relief for cables. Panels shall be labeled with alphanumeric x-y coordinates.

2.3.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible shielded twisted pair cable with shielded twisted pair type connectors at each end. Cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed performance requirements for Type 6A patch panel data cable. Connectors shall meet or exceed the requirements of EIA ANSI/TIA/EIA-568-B for media interface connectors. Patch cords shall be factory assembled.

2.4 COAXIAL CABLE SYSTEM

2.4.1 Backbone Cable

Backbone cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE5 for coaxial cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP per NFPA 70. Cable shall have band markings every 8 feet for transceiver tap placement.

2.4.2 Horizontal Cable

Horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE2 for coaxial cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP per NFPA 70.

2.4.3 Connecting Hardware

2.4.3.1 Connectors

Connectors shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE5 or 10BASE2 for coaxial cable connectors, as required for the service. Connectors for riser/backbone cable shall be Type N male. Station cable faceplates shall be provided and shall be ivory in color, impact resistant plastic, with double-sided female BNC coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

2.4.3.2 Patch Panels

Patch panels shall be 19 inch rack mounted panels. Connectors shall be double-sided BNC female, feedthrough type. Connector mounting surface shall be constructed with a dielectric material. BNC feedthrough connectors shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE2 for coaxial cable connectors. Panels shall be labeled with alphanumeric x-y coordinates.

2.4.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible coaxial cable with BNC male connectors at each end. Cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE2 for coaxial cable. Connectors shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE2 for coaxial cable connectors.

2.5 FIBER OPTIC CABLE SYSTEM

2.5.1 Backbone Cable

2.5.1.1 Multimode

Multimode fiber optic backbone cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B and ICEA S-83-596 for 62.5/125 micrometer multimode graded index optical fiber cable. Numerical aperture for each fiber shall be a minimum of 0.275. Cable construction shall be tight buffered type. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count and aggregate length at regular intervals. Cable shall be rated OFNR per NFPA 70.

2.5.2 Horizontal Distribution Cable

2.5.2.1 Multimode

Multimode fiber optic horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B and ICEA S-83-596 for 62.5/125 micrometer multimode graded index optical fiber cable. Numerical aperture for each fiber shall be a minimum of 0.275. Cable construction shall be tight buffered type, two strands. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals of 2 feet. Cable shall be rated and marked OFNP per NFPA 70.

2.5.3 Connecting Hardware

2.5.3.1 Connectors

Connectors shall be ST type with ceramic ferrule material with a maximum insertion loss of .5 dB. Connectors shall meet performance requirements of EIA ANSI/TIA/EIA-568-B. Connectors shall be field installable. Connectors shall utilize adhesive for fiber attachment to ferrule. Connectors shall terminate fiber sizes as required for the service. Station cable faceplates shall be provided and shall be ivory in color, impact resistant plastic, with double-sided female ST coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

2.5.3.2 Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing,

radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be 19 inch rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be labeled with alphanumeric x-y coordinates. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.5.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible optical fiber cable with connectors of the same type as used elsewhere in the system. Optical fiber shall be the same type as used elsewhere in the system. Patch cords shall be complete assemblies from manufacturer's standard product lines.

2.6 EQUIPMENT RACKS

2.6.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be welded steel relay racks with uprights to mount equipment 19 inches wide. Uprights shall be 3 inch deep channel, 1-1/4 inches wide, drilled and tapped 12-24 in a 1/2 inch pattern. Racks shall be provided with a standard top crossmember, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 7 feet in height and clear coated. AC outlets shall be provided as shown.

2.6.2 Wall Mounted Open Frame

Wall mounted open frame equipment racks shall be steel relay racks to mount equipment 19 inches wide with standoff brackets for wall mounting. Uprights shall be drilled and tapped 12-24 in a 1/2 inch pattern. Standoff brackets shall be of sufficient length for a 6 inch clearance between rack and wall. Wall mounted open frame racks shall be hinged. AC outlets shall be provided as shown.

2.6.3 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 inch equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lockwashers.

2.6.4 Floor Mounted Cabinets

Equipment cabinets shall be floor mounted enclosures with side panels, acrylic plastic front doors, rear louvered metal doors, depth-adjustable front and rear mounting rails, and louvered top. Ventilation fans will be included. Vertical cable management devices shall be integral to the cabinet. Power strips with 12 outlets shall be provided within the cabinet. Equipment racks shall mount equipment 19 inches wide and shall be 72 inches high and 30 inches deep. Cabinet exteriors shall be painted blue.

2.6.5 Wall Mounted Cabinets

Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than shown on drawings. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 3/4

inch plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.7 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with white or light colored paint.

2.8 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 4-11/16 inch square by 2-1/8 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Provide a minimum 1 inch conduit.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with EIA ANSI/TIA/EIA-606. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840A FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with EIA ANSI/TIA/EIA-568-B and as specified in Section 16415A ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA ANSI/TIA/EIA-606. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Fiber optic cables shall be installed either in conduit or through type cable trays to prevent microbending losses. Copper cable not in a wireway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. In raised floor areas, cable shall be installed after the flooring system has been installed. Cable 6 feet long shall be neatly coiled not less than 12 inches in diameter below each feed point in raised floor areas.

3.1.2 Riser and Backbone Cable

Vertical cable support intervals shall be in accordance with manufacturer's recommendations. Cable bend radius shall not be less than ten times the

outside diameter of the cable during installation and once installed. Maximum tensile strength rating of the cable shall not be exceeded. Cable shall not be spliced.

3.1.3 Telecommunications Outlets

3.1.3.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

3.1.3.2 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.3.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have fiber optic cable installed.

3.1.4 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

3.1.5 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 10 percent spares. Cable guides shall be provided above, below and between each panel.

3.1.6 Fiber Optic Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 10 percent spares. A slack loop of fiber shall be provided within each panel. Loop shall be 3 feet in length. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.7 Equipment Racks

Open frame equipment racks shall be bolted to the floor. Cable guides shall be bolted or screwed to racks. Racks shall be installed level. Ganged racks shall be bolted together. Ganged rack cabinets shall have adjacent side panels removed. Wall mounted racks shall be secured to the mounting surface to prevent fully loaded racks from separating from the mounting surface.

3.1.8 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.1.9 Spare Parts

The Contractor shall provide spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in EIA ANSI/TIA/EIA-568-B. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.2.2 Shielded Twisted Pair Cable

Each cable shall be terminated on panel-mounted connectors. Cables shall be grounded at patch panels using manufacturer's recommended methods. Shield braid shall be continuous to connector braid terminator. Wire insulation shall not be damaged when removing shield.

3.2.3 Coaxial Cable

Home run type station cables shall be terminated at each end. Backbone cables shall be terminated with appropriate connectors or end-of-line terminators as required. Loop-type cable systems shall be terminated with appropriate drop connectors and terminators as required. Backbone cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.2.4 Fiber Optic Cable

Each fiber shall have connectors installed. The pull strength between the connector and the attached fiber shall be not less than 25 pounds. The mated pair loss, without rotational optimization, shall not exceed 1.0 dB. Fiber optic connectors shall be installed per EIA ANSI/TIA/EIA-568-B.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with EIA ANSI/TIA/EIA-607 and Section 16415A ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

- a. 10 of each type outlet.

- b. 10 of each type cover plate.
- c. 1 of each type terminal block for each telecommunications closet.
- d. 4 Patch cords of 10 feet for each telecommunications closet.
- e. 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

3.5 ADMINISTRATION AND LABELING

3.5.1 Labeling

3.5.1.1 Labels

All labels shall be in accordance with EIA ANSI/TIA/EIA-606.

3.5.1.2 Cable

All cables will be labeled using color labels on both ends with encoded identifiers per EIA ANSI/TIA/EIA-606.

3.5.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using color coded labels with encoded identifiers per EIA ANSI/TIA/EIA-606.

3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made in accordance with the approved Test Plan submitted by the Contractor, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided. The Contractor shall submit Test Reports as they are completed.

3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

3.6.2 Category 6 Circuits

All category 6 circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA TIA/EIA-TSB-67 standard, including the additional tests and test set accuracy requirements of EIA ANSI/TIA/EIA-568-B.2-1. Testing shall use the Basic Link Test procedure of EIA TIA/EIA-TSB-67, as supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Cables

and connecting hardware which contain failed circuits shall be replaced and retested to verify the standard is met.

3.6.3 Shielded Twisted Pair

Wiring configuration shall be tested for continuity, opens, shorts, swaps and correct pin configuration; dc resistance both pair-to-pair and wire-to-shield shall be verified. Cable lengths shall be verified. Near end crosstalk shall be tested from 772 kHz to 300 MHz. Ground potential difference between wiring closets, ground potential difference between patch panel and wall outlet, and ground path resistance shall be tested per IBM GA27-3361-07.

3.6.4 Coaxial Cable

Cable shall be tested for continuity, shorts and opens. Characteristic impedance shall be verified over the range of intended operation. Cable length shall be verified. Cable shall be sweep tested for attenuation over the range of intended operation.

3.6.5 Fiber Optic Cable

Unless stated otherwise, tests shall be performed from both ends of each circuit. Connectors shall be visually inspected for scratches, pits or chips and shall be reterminated if any of these conditions exist. Each circuit leg and complete circuit shall be tested for insertion loss at 850 and 1300 nm using a light source similar to that used for the intended communications equipment. High-resolution optical time domain reflectometer (OTDR) tests shall be performed from one end of each fiber. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80 percent of the X-axis.

-- End of Section --

SECTION 16711A

TELEPHONE SYSTEM, OUTSIDE PLANT

11/01

AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C62.61 (1993) Gas Tube Surge Arresters on Wire
Line Telephone Circuits

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2239 (1999) Polyethylene (PE) Plastic Pipe
(SIDR-PR) Based on Controlled Inside
Diameter

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/EIA-455-81A-91 (1992) FOTP-81 Compound Flow (Drip) Test
for Filled Fiber Optic Cable

EIA ANSI/EIA/TIA-455-30B (1991) FOTP-30 Frequency Domain
Measurement of Multimode Optical Fiber
Information Transmission Capacity

EIA ANSI/EIA/TIA-455-53A (1990) FOTP-53 Attenuation by Substitution
Measurement for Multimode Graded-Index
Optical Fibers or Fiber Assemblies Used in
Long Length Communications Systems

EIA ANSI/EIA/TIA-455-78A-98 (1990; R 1998) FOTP-78 Spectral
Attenuation Cutback Measurement for Single
Mode Optical Fibers

EIA ANSI/TIA/EIA-568-A (1995; Addendum 3 1998) Commercial
Building Telecommunications Cabling
Standard

EIA ANSI/TIA/EIA-607 (1994) Commercial Building Grounding and
Bonding Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 345-50	(1979) Trunk Carrier Systems
RUS 345-65	(1985) Shield Bonding Connectors
RUS 345-72	(1995) Field Splice Closures
RUS REA Bull 345-151	(1989) Conduit and Manhole Construction, REA Form 515c
RUS Bull 1751F-643	(1998) Underground Plant Design
RUS Bull 1753F-302	(1994) Outside Plant Housings and Serving Area Interface Systems
RUS Bull 1753F-401 (PC-2)	(1995) RUS Standard for Splicing Copper and Fiber Optic Cables
RUS IP 344-2	(1999) List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrowers
RUS REA Bull 1751F-641	(1995) Construction of Buried Plant
RUS REA Bull 1753F-201	(1976) Acceptance Tests and Measurements of Telephone Plant
RUS REA Bull 1753F-205	(1993) REA Specification for Filled Telephone Cables
RUS REA Bull 1753F-207	(1994) Terminating (TIP) Cable
RUS REA Bull 1753F-208	(1993) Filled Telephone Cables with Expanded Insulation
RUS REA Bull 1753F-601 (PE-90)	(1994) REA Specification for Filled Fiber Optic Cables

UNDERWRITERS LABORATORIES (UL)

UL 497	(1995; Rev Oct 1999) Protectors for Paired Conductor Communication Circuits
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment

1.2 SYSTEM DESCRIPTION

The outside plant system shall consist of all cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, terminating cables, lightning and surge protection modules at the entry facility. The work consists of furnishing, installing, testing and making operational a complete outside plant system for continuous use.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telephone System; G
Installation; G

Detail drawings, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, and catalog cuts. Detail drawings shall also contain complete configuration information, wiring diagrams and any other details required to demonstrate that the cable system has been coordinated to support the transmission systems identified in the specifications and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations.

Record Drawings; G

Record drawings for the installed wiring system showing the actual location of all cable terminations, splices, routing, and size and type of all cables. The identifier for each termination and cable shall appear on the drawings. The drawings shall include gauge and pair or fiber count for each cable, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector block layout at the termination points after installation.

SD-03 Product Data

Spare Parts; G
Equipment; G

A data list of recommended spare parts, tools, and test equipment for each different item of material and equipment specified prior to beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Installation; G

Printed copies of the manufacturer's recommendations for the material being installed, prior to installation. Installation of the item will not be allowed to proceed where installation procedures, or any part thereof, are required to be in accordance with those recommendations until the recommendations are received and approved.

Acceptance Tests; G

Test plans defining all tests required to ensure that the system meets specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and

supplies required. The test plans shall identify the capabilities and functions to be tested.

Cutover and Records; G

The cutover plan shall provide procedures and schedules for relocation of facility station numbers without interrupting service to any active location.

SD-06 Test Reports

Acceptance Tests; G

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

SD-07 Certificates

Telephone System; g

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL, where materials and equipment are so specified.

Qualifications; G

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.4 QUALIFICATIONS

1.4.1 Cable Installers

Installation shall be under the direct supervision of an individual with a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Cable Splicing and Termination

All cable splicers shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

1.4.3 Manufacturers

The cable, equipment, and hardware provided shall be from manufacturers that have a minimum of 3 years experience in producing the types of cable, equipment, and hardware specified.

1.5 DELIVERY AND STORAGE

1.5.1 Cable Requirements-

All cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable during reeling and unreeling. The reels shall be constructed to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the

reel head to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, with sufficient length to make it available for testing. The inner end shall be fastened to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 to plus 148 degrees F, with relative humidity from 0 to 100 percent.

1.5.2 Equipment

All equipment shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants, in accordance with the manufacturer's requirements.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment. All products supplied shall be specifically designed and manufactured for use with outside plant communications systems. All items of the same class of equipment shall be the products of a single manufacturer.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Underground

Cable shall be manufactured per RUS REA Bull 1753F-205 or RUS REA Bull 1753F-208. A 8 mil coated aluminum or 5 mil copper metallic shield shall be provided.

2.2.1.2 Screened

Screened cable shall comply with RUS REA Bull 1753F-205 or RUS REA Bull 1753F-208.

2.2.2 Fiber Optic Cable

Fiber optic cable shall be specifically designed for outside use with tight or loose buffer construction. The tight buffer optical fiber cable shall consist of a central glass optical fiber surrounded by a soft intermediate buffer to allow for thermal expansions and proper fitting of the secondary buffer. The loose buffer optical fiber cable shall have the glass optical fiber within a filled loose tube. All fiber optic cables used shall conform to the requirements of RUS REA Bull 1753F-601 (PE-90) including any special requirements made necessary by a specialized design..

2.2.2.1 Cable Cores

A central, nonmetallic core member shall be included to serve as a cable core foundation to reduce strain on the fibers, but not to serve as a pulling strength member.

2.2.2.2 Optical Fiber

Single-mode optical fibers shall be Class IV. Multi-mode optical fibers shall be Class Ia.

2.2.2.3 Shielding or Other Metallic Covering

A copper, copper alloy, or copper and steel laminate metallic covering or shield shall be provided per RUS REA Bull 1753F-601 (PE-90).

2.2.2.4 Performance Requirements

The fiber optic cable shall comply with the specified mechanical performance requirements while used in buried and underground duct applications where the temperature varies from minus 5 to plus 140 degrees F. Optical performance degradation shall be less than 5 percent of the optical performance requirements in the temperature range of minus 5 to plus 140 degrees F. The fiber optic cable shall not be damaged in storage where the temperature may vary from minus 40 to plus 148 degrees F.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Underground Closure

Underground closures shall conform to RUS 345-72. The closure shall be of thermoplastic, thermoset, or stainless steel material and be suitable for use in a vault or manhole.

2.3.2 Fiber Optic Closures

2.3.2.1 Fiber Optic Underground

The underground closure shall be suitable to house a splice organizer in a protective housing. An encapsulating compound shall be poured into this enclosure. The closure shall be of thermo-plastic, thermoset-plastic, or stainless steel material and suitable for use in a vault or manhole. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure.

2.4 CABLE SPLICES AND ORGANIZERS

2.4.1 Copper Cable Splices

All cables greater than 25 pairs shall be spliced using modular splicing connectors, which accommodate 25 pairs of conductors at a time. The correct connector size shall be used to accommodate the wire gauge of the cable to be spliced. The connectors used shall be listed in RUS IP 344-2.

2.4.2 Fiber Optic Cable Splices

Each fiber optic splice shall be physically protected by a splice kit. The kit shall be specially designed for the splice.

2.4.3 Fiber Optic Splice Organizer

The splice organizer shall be suitable for housing fiber optic splices in a neat and orderly fashion. The splice organizer shall allow for a minimum of 3 feet of fiber for each fiber within the cable to be neatly stored without kinks or twists. The splice organizer shall accommodate individual strain relief for each splice. The splice organizer shall allow for future maintenance or modification, without damage to the cable or splices. All required splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors shall be provided in the organizer kit.

2.5 CABLE TERMINALS

2.5.1 Pedestal-Type Cable Terminals

Pedestal-type cable terminals shall conform to RUS Bull 1753F-302.

2.5.2 Cross-connect Cable Terminals

Cross-connect cable terminals shall be weatherproofed for outdoor use and suitable for pole, pad, or stake mounting. The terminal shall be equipped with mounting columns and distribution rings for jumper-wire routing. The terminal shall be of aluminum or steel construction and ribbed for strength.

2.6 MANHOLE AND DUCT

All manhole and duct products shall conform to RUS Bull 1751F-643.

2.6.1 New Manholes

New manholes shall be equipped with pulling-in irons, cable racks, and ground rod, and conform to the requirements of RUS REA Bull 345-151. Manholes shall be a minimum of 12 feet long by 6 feet wide by 6.5 feet high. Manholes shall be designed so that the main trunk conduits enter and exit near the center of the ends, and lateral conduits exit on the sides near the corners. Manholes may be pre-cast or cast in place.

2.6.2 Manhole Overbuilds

Existing manholes which are enlarged as part of this project shall be equipped with new pulling-in irons, cable racks, and ground rod.

2.6.3 Duct/Conduit

Conduit shall be furnished as specified in Sections 16415 ELECTRICAL WORK, INTERIOR and 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown on project drawings.

2.6.4 Innerduct

Innerduct shall be SIDR 11.5 polyethylene plastic pipe conforming to ASTM D 2239.

2.7 EQUIPMENT RACKS

Distribution frames, cabinets, and back-boards shall be provided as shown and designed to mount connector blocks, protector blocks, cross connects, and other hardware required to terminate and protect the outside telephone plant cable; to provide a demarcation point between inside and outside

plant cable; and to allow inside and outside plant cable to be cross connected.

2.7.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be single sided welded steel relay racks with uprights to mount equipment 19 inches wide. Uprights shall be 3 inch deep channel, 1-1/4 inch wide, drilled and tapped 12-24 in a 1/2 inch pattern. Racks shall be provided with a standard top cross-member, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 7 feet in height and painted blue. AC outlets shall be provided as shown.

2.7.2 Wall Mounted Open Frame

Wall mounted open frame equipment racks shall be steel relay racks to mount equipment 19 inches wide with standoff brackets for wall mounting. Uprights shall be drilled and tapped 12-24 in a 1/2 inch pattern. Standoff brackets shall be of sufficient length for a 6 inch clearance between rack and wall. Wall mounted open frame racks shall be hinged. AC outlets shall be provided as shown.

2.7.3 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 inch equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lock-washers.

2.7.4 Floor Mounted Cabinets

Equipment cabinets shall be floor mounted enclosures with side panels, acrylic plastic front doors, rear louvered metal doors, depth-adjustable front and rear mounting rails, and louvered top. Ventilation fans shall not be included. Vertical cable management devices shall be integral to the cabinet. Power strips with 12 outlets shall be mounted within the cabinet. Equipment racks shall mount equipment 19 inches wide and shall be 72 inches high and 30 inches deep. Cabinet exteriors shall be painted blue.

2.7.5 Wall Mounted Cabinets

Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than shown on drawings. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 3/4 inch plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet.

2.7.6 Equipment Mounting Backboard

Backboards shall be 3/4 inch AC plywood, sized as shown, painted with white or light colored paint.

2.8 CONNECTOR BLOCKS

Connector blocks consisting of flame-retardant molded plastic fastened to a metal mounting bar shall be provided to terminate the outside plant cable

as shown. The connector blocks shall be of 100-pair block size and equipped with protection modules. The connector blocks shall be 24 gauge stub type. The cable stubs shall be 100 pair and conform to RUS REA Bull 1753F-207.

2.9 PROTECTOR MODULES

The protector modules shall be of the two-element gas tube type. Protection modules shall be heavy duty, $A > 10$ kA, $B > 400$, $C > 65A$ where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current per ANSI C62.61. The gas modules shall shunt high voltage to ground, fail short, be equipped with an external spark gap and heat coils, and shall comply with UL 497.

2.10 FIBER-OPTIC TERMINATIONS

2.10.1 Fiber Optic Connectors

All outside plant fiber strands shall be terminated in a [AM#2] _____ ST type fiber optic connector, with ceramic ferrule material and a maximum insertion loss of 0.5 dB. Connectors shall meet performance standards of EIA ANSI/TIA/EIA-568-A. If pre-connectorized cable assemblies or pigtails are used, the connectors shall be terminated on a 10 foot length of single-fiber cable. The single-fiber cable shall contain a buffered optical fiber of the same type and specification as that used in the multi-fiber cable.

2.10.2 Fiber Optic Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be 19 inch rack mounted panels. Patch panels shall provide strain relief for cables. Panels shall be provided with labeling space. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.11 MISCELLANEOUS ITEMS

2.11.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with RUS 345-65.

2.11.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.11.3 Warning Tape

Marking and locating tape shall be acid and alkali resistant polyethylene film, 6 inches wide with a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core shall be encased

in a protective jacket or provided with other means to protect it from corrosion and shall be specifically manufactured for marking and locating underground utilities. The warning tape shall be orange in color and continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 48 inch intervals.

2.11.4 Cable Warning Signs

Cable warning signs, which identify the route of buried cable, shall be stake mounted. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer's instructions. Warning signs shall be placed at intervals of no more than 500 feet and at each change of direction in the cable route. Warning signs shall also be placed on each side of every crossing of surface obstacles such as roads, railroads, stream crossings, or any similar crossing where excavation is likely to occur.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All installation work shall be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and NFPA 70.

3.1.1 Cable Inspection and Repair

All cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.2 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in RUS REA Bull 1751F-641.

3.1.2.1 Cable Pulling

For cable installed in ducts and conduit, a cable feeder guide shall be used, between the cable reel and the face of the duct and conduit, to protect the cable and guide it into the duct and conduit as it is paid off the reel. As the cable is paid off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is paid off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not cause the cable to be twisted or stretched.

3.1.2.2 Penetrations for Cable Access

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in section 07840 FIRE STOPPING. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.2.3 Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter. Only large radius sweeps shall be used in conduit runs and shall not exceed a cumulative 90 degrees between manholes.

3.1.3 Manhole and Ducts

Manhole and duct systems shall be installed in accordance with Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Manholes shall be placed in line with the main duct. Splice cases shall be mounted in the center on the long sides. Lateral conduits shall exit the long sides near the corners.

3.1.3.1 Innerduct Installation

Innerduct shall be pulled through existing duct-manhole system in continuous sections. Splices, joints, couplings, or connections of any type will not be allowed between manholes. Innerduct shall be plugged at both ends with polyurethane foam duct seal; this material shall also be inserted between the innerduct and the duct if cables are placed in the innerducts. Only one cable shall be installed in a given innerduct. Existing and new unoccupied innerducts shall be trimmed leaving 2 inches exposed.

3.1.3.2 Pull Cord

Pull cords of 3/8 inch polypropylene shall be installed in all unused ducts and inner-ducts with a minimum of 2 feet spare cord protruding from each end.

3.1.4 Surge Protection

Except for fiber optic cable, all cables and conductors, which serve as communication lines, shall have surge protection meeting the requirements of RUS 345-50 installed at the entry facility.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with RUS Bull 1753F-401 (PC-2). Modular splicing shall be used on all cables larger than 25 pairs.

3.2.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with the manufacturer's recommendation; each splice shall have a loss of less than 0.1 dB.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded. Grounding shall be in accordance with requirements of NFPA 70, Articles 800-33 and 800-40.

3.3.1 Ground Bars

3.3.1.1 Telecommunications Master Ground Bar (TMGB)

A copper TMGB shall be provided, in accordance with EIA ANSI/TIA/EIA-607, to be the hub of the basic grounding system by providing a common point of connection for ground from outside cable, MDF, and equipment. The TMGB shall have a ground resistance, including ground, of 10 ohms or less.

3.3.1.2 Telecommunications Ground Bar (TGB)

Copper TGB shall be provided in accordance with EIA ANSI/TIA/EIA-607 in each communications closet and room and each frame. The TGB shall be connected to the TMGB in accordance with EIA ANSI/TIA/EIA-607. Each TGB shall be connected to the TMGB by the most direct route utilizing a copper wire conductor with a total resistance of less than 0.01 ohms.

3.3.2 Incoming Outside Plant Cables

All incoming outside plant cable shields shall be bonded directly to the TMGB or the closest TGB.

3.3.3 Cable Stubs

All shields of cable stubs shall be bonded to a TGB located on the frame.

3.3.4 Shields

The shields of all incoming cables shall not be bonded across the splice to the cable stubs.

3.3.5 Protection Assemblies

The protector assemblies shall be mounted directly on the vertical frame ironwork. The assemblies mounted on each vertical frame shall be connected with a No. 6 AWG copper conductor to provide a low resistance path to the TGB.

3.3.6 Manholes

The shields of all cables in each manhole shall be bonded together by a bonding wire or ribbon. At intermediate manholes, where the cable is pulled through without a sheath opening, bonds are not required. If the manhole has a lacerating bonding ribbon, the shields of spliced cables shall be attached to it.

3.4 CUTOVER AND RECORDS

All necessary transfers and cutovers, shall be accomplished by the Contractor.

3.5 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test; testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.5.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with RUS REA Bull 1753F-201:

- a. Shield continuity.
- b. Conductor continuity.
- c. Conductor insulation resistance.
- d. Structural return loss.
- e. Cable insertion loss and loss margin at carrier frequencies.
- f. Shield ground for single jacketed cables.
- g. DC loop resistance.

3.5.2 Fiber Optic Cable

Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test shall be performed on all multi-mode optical fibers. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

3.5.2.1 OTDR Test

The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings, improper splices, for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 3280 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. The OTDR test shall be conducted in accordance with EIA ANSI/EIA-455-81A-91 for single-mode fiber and EIA ANSI/EIA/TIA-455-78A-98 for multi-mode fiber. Splice losses shall not exceed 0.1db. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multi-mode fiber.

3.5.2.2 Attenuation Test

End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 850 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met. The measurement method shall be in accordance with EIA ANSI/EIA/TIA-455-53A.

3.5.2.3 Bandwidth Test

The end-to-end bandwidth of all multi-mode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with EIA ANSI/EIA/TIA-455-30B.

-- End of Section --